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L. M. B. C. REPORTS. No. I.

THE FIRST REPORT

UPON THE

FAUNA OF LIVERPOOL BAY

AND THE

NEIGHBOURING SEAS,

WRITTEN BY THE MEMBERS OF THE

LIVERPOOL MARINE BIOLOGY COMMITTEE,

AND EDITED BY

W. A. HERDMAN, D.Sc., F.L.S.,
PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL.

WITH TEN PLATES AND TWO MAPS.

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INTRODUCTION.

It seems desirable to make a brief statement in regard to the mode of origin and the objects of the Liverpool Marine Biology Committee as an introduction to this First Report on the Fauna of Liverpool Bay.* As the result of an informal conversation with some of the local naturalists, an address was given on March 6th, 1885, by Professor Herdman to the members of the Liverpool Microscopical Society, pointing out some of the characteristics of the Marine Fauna, and urging the necessity for an exploration of the estuary of the Mersey. In consequence of the discussion which took place on this occasion, the following circular was shortly afterwards sent out to members of the local scientific societies and others likely to be interested in the matter:—

"MARINE BIOLOGY.

A Meeting will be held in the Zoological Laboratory, University College, Liverpool, on Saturday, March 14th, at 3 p.m., to discuss the proposed scheme for a thorough investigation of the Fauna and Flora of the neighbouring seas.

W. A. Herdman."

This meeting was attended by representatives of the scientific societies and museums of Liverpool, Manchester, and Chester, and by a number of the local naturalists. After a considerable amount of discussion it was unanimously resolved "that steps should be taken to investigate the Marine Biology of Liverpool Bay during the coming summer, with the view of compiling a 'Fauna' of the neigh-

* The L. M. B. C. District, or Liverpool Bay in a wide sense, is that part of the Irish Sea bounded by the coast of Lancashire, the north coast of Wales, and the Isle of Man.

bourhood, the arrangement of details being left in the hands of a small committee." The following gentlemen were then appointed as the Liverpool Marine Biology Committee :—

F. Archer, Esq., B.A., Crosby.
R. D. Darbishire, Esq., B.A., F.G.S., Manchester.
R. J. Harvey Gibson, Esq., M.A., F.R.S.E., University College, Liverpool.
Professor Herdman, D.Sc., F.R.S.E., F.L.S., University College, Liverpool.
Rev. H. H. Higgins, M.A., Free Public Museum, Liverpool.
A. Leicester, Esq., Waterloo.
Professor A. Milnes Marshall, D.Sc., F.R.S., Owens' College, Manchester.
T. J. Moore, Esq., C.M.Z.S., Curator, Free Public Museum, Liverpool.
James Poole, Esq., J.P., Liverpool.
Isaac Roberts, Esq., F.G.S., Maghull.
I. C. Thompson, Esq., F.R.M.S., Liverpool.
A. O. Walker, Esq., F.L.S., Chester.

This Committee resolved to make arrangements for—

1st, organising dredging, tow-netting, and other collecting expeditions;
2nd, the examination and description of the specimens obtained; and,
3rd, the publication of the results.

It was intended at first to obtain subscriptions from those interested in the work for the purpose of hiring a steam-tug for the dredging expeditions, but, owing to the liberality of a few gentlemen in placing suitable vessels at the disposal of the Committee, that step has not yet been found necessary.

Early in April, a letter was received from Mr. George Holt offering to provide a steam-tug for the first dredging

expedition of the Committee. The expedition took place on the 9th of May, in the tug "Merry Andrew," chartered by Mr. Holt, and was attended by most of the members of the Committee and a few other naturalists. After some unsuccessful hauls of the dredge in the Rock Channel,* opposite Bidston Lighthouse, at a depth of five fathoms, on a sandy bottom, when only a few Zoophytes and Polyzoa were obtained, the "Merry Andrew" proceeded to Hilbre Swash, the deep channel which runs northwards from Hilbre Island, at the eastern mouth of the river Dee, and there dredging, trawling, and tow-netting operations were carried on during the remainder of the day. Hilbre Swash is the deepest part of the area of Liverpool Bay inside the Bar Lightship, depths of nine, ten, and eleven fathoms being frequently found in it. The bottom varies from a fine stiff grey mud to sand and gravel, with occasional lumps of coarse red sandstone, more or less covered with Hydroids, Polyzoa, Sponges, and other incrusting animals. The most prolific locality examined was found to be a spot close to the north-west end of Hilbre Island, at a depth of ten fathoms.

The more important species obtained in this expedition were the following:—†

Cœlenterata.—*Hydractinia echinata, Tubularia indivisa, Garveia nutans, Calycella syringa, Sertularia filicula, Actinoloba dianthus*, and *Alcyonium digitatum.*

Polyzoa.—*Crisia eburnea, Cellepora pumicosa, Idmonea serpens, Flustra foliacea, Scrupocellaria scrupea, Amathia lendigera, Gemellaria loricata.*

Polychæta.—*Sabella penicillus, Serpula vermicularis.*

* For this and the other localities mentioned, see the accompanying Chart (Pl. XI).

† Preliminary accounts, giving the results of the various expeditions, have been published in the Liverpool papers. See *Liverpool Daily Post*, May 11, May 28, June 15, June 22, July 14.

CRUSTACEA.—*Caprella linearis*, *Pagurus bernhardus*, *Porcellana longicornis*, and *P. platycheles*, *Hyas araneus*, *Portunus depurator*, and *Stenorhynchus rostratus*.

MOLLUSCA.—*Pholas candida*, *Ancula cristata*, *Tritonia plebeia*, *Doto coronata*.

In the tow nets, *Pleurobrachia*, Medusoid Gonophores (chiefly species of *Thaumantias*), and Copepoda were taken in great abundance. The specimens collected were all brought to the Zoological Laboratory of University College, and were there roughly arranged in groups, preserved in alcohol or picric acid solution, labelled, and stored away.

The most important result of this expedition was, undoubtedly, the discovery of *Garveia nutans*. This rare Zoophyte * had not been previously found in this neighbourhood, although the investigations of the Liverpool Marine Biology Committee have shown that it is widely distributed over the area, and, apparently, is fairly abundant in the neighbourhood of Hilbre Island.

About the middle of May, a letter was received from Mr. N. RUNDELL, Jun., offering, on behalf of the Liverpool Salvage Association, to allow the Marine Biology Committee to have the use of the S.S. "Hyæna" for a three days' cruise along the coast of North Wales. This afforded a welcome opportunity for investigating one of the more outlying parts of the district which could not be overtaken in a single day's expedition; so it was decided that the region in the neighbourhood of the Great Ormes Head, Puffin Island, and the entrance to the Menai Straits, should be specially explored. About twenty naturalists took part in the expedition, which occupied three complete days, the 23rd, 24th, and 25th of May. Between thirty and forty hauls of the dredge and trawl

* See *Report upon the Hydroida*, p. 99.

were taken during this cruise of the "Hyæna," and the collection of animals obtained was very considerable.

On the 23rd May, the dredge was first let over on the western end of the Constable Bank, near Llandudno. At this spot three hauls were taken in depths of from six to seven fathoms, resulting in the capture of various species of Hydroids and Polyzoa, *Pectinaria belgica, Corystes cassivelaunus, Thia polita,* and *Loligo media.* Later on in the same day, several hauls of the trawl were taken a short distance off the Great Ormes Head, in depths of from seven to eight fathoms. Amongst the animals obtained were :—

HYDROIDA.—*Coppinia arcta, Tubularia indivisa.*

POLYCHÆTA.—*Sabellaria alveolata.*

ECHINODERMATA. — *Solaster papposa, Echinocyamus pusillus, Echinocardium cordatum, Cucumaria pentactes.*

CRUSTACEA.—*Hyas coarctatus, Stenorhynchus rostratus, Pilumnus hirtellus,* and *Portunus depurator.*

MOLLUSCA.—*Mactra solida* (large), *Mactra stultorum* (pale variety), *Anomia patelliformis, Pecten pusio, Pecten varius, Pholas candida, Trochus zizyphinus, Pleurotoma turricula, Fusus gracilis, Murex erinaceus,* and *Dendronotus arborescens.*

On the 24th of May, operations were commenced to the north of Puffin Island,* where several successful hauls were taken in depths of from eleven to fourteen fathoms.

Amongst other species obtained in this locality were :—

CRUSTACEA.—*Mysis spiritus, Pandalus brevirostris, Hippolyte cranchii, Crangon trispinosus* and *C. fasciatus, Hippolyte pusiola, Portunus corrugatus* and *Eurynome aspera.*

PYCNOGONIDA.—*Pephredo hirsuta* (?), *Achelia echinata*

* See *Chart,* Pl. XI.

and *A. hispida*, *Phoxichilidium femoratum*, *Phoxichilus spinosus*.

Mollusca.—*Doto coronata*, *Doto fragilis*, *Eolis gracilis*, *Mytilus barbatus*, *Anomia patelliformis*, and *Sepiola atlantica*.

Later on in the day, in the Menai Straits, nearly opposite Bangor, at a depth of about ten fathoms, the small red Ascidian, *Styela grossularia*, was obtained in quantity. Specimens of *Ascidia virginea*, *Polycyclus savignyi*, and *Alcyonidium gelatinosum* were also obtained in the Straits, along with many dead shells.

On the morning of the 25th, the third day of the cruise, a few hauls of the dredge were taken in fourteen fathoms, between Puffin Island and Anglesea. In this channel, *Ophiothrix pentaphyllum* must be very abundant since it came up in dredgefuls. Amongst the Mollusca obtained here were:—*Modiola barbata*, *Sphenia binghami*, *Scrobicularia prismatica*, *Scrobicularia alba*, *Tellina donacina*, *Saxicava rugosa*, *Cardium norvegicum*, and *Eledone cirrhosa*.

The trawl was then let down off Red Wharf Bay, on the north coast of Anglesea, but resulted in little worthy of note except *Dentalium entale* and a large specimen of *Eolis picta*. On the way back to Liverpool, a few hauls were taken in fourteen fathoms, about six miles to the north of the Great Ormes Head. Here a large specimen of *Astropecten irregularis* was obtained, with the rare Annelid *Malmgrenia castanea* * as a commensal in one of the ambulacral grooves. Amongst the other species observed were:—

Hydroida.—*Garveia nutans*, *Campanularia verticillata*, *Sertularella polyzonias* and *Sertularia operculata*.

Polyzoa.—*Vesicularia spinosa*.

Tunicata.—*Botrylloides rubrum*.

* See *Report upon the Vermes*, p. 149.

Polychæta.—*Aphrodite aculeata.*

Mollusca.—*Lima loscombii* and *Corbula gibba.*

The most important forms obtained during the cruise of the "Hyæna" were :—*Garveia nutans, Cucumaria pentactes, Malmgrenia castanea, Mysis spiritus, Thia polita, Pilumnus hirtellus, Pandalus brevirostris, Eolis gracilis, Eolis picta, Sepiola atlantica,* and *Loligo media.*

The tow-nets were used frequently, capturing Medusoid Gonophores, *Pleurobrachia,* many Copepoda, and various larval forms (chiefly Crustacea).

During May, June, and July, several expeditions were organised to explore Hilbre Island and the neighbourhood at low tides. These were largely attended, and very considerable collections have been formed of the species living between tide marks on the shore.

Hilbre Island is well known amongst the local naturalists on account of its comparatively rich marine fauna. It is certainly the most interesting spot in Liverpool Bay from a biological point of view, and it would be the most suitable locality, within a reasonable distance from Liverpool, for the establishment of a marine laboratory for carrying on biological investigations.

The rocks at the northern end of the Island are covered at and about low water mark by a rich and varied assemblage of invertebrate animals, and form a particularly favourable locality for certain Hydroid Zoophytes, Actiniæ, Polyzoa, and Nudibranchs. A complete account of the fauna of Hilbre Island, with a description of the conditions, so far as they are known, under which the various species live, is one of the objects which the Liverpool Marine Biology Committee have set before them, and it will probably form a considerable part of one of their future Reports.

Among the more important species which were found

last summer on the shores of Hilbre Island are the following:—

Porifera.—*Sycandra ciliata, Isodictya varians, Suberites carnosa, Halisarca dujardinii.*

Cœlenterata.—*Clava multicornis, Garveia nutans, Tubularia indivisa, Tubularia larynx, Coryne pusilla, Obelia dichotoma, Sertularella rugosa, Actinoloba dianthus,* var. *rubida, Cylista undata.*

Echinodermata.—*Echinus esculentus, Asterias rubens, Echinocyamus pusillus.*

Polychæta.—*Sabellaria alveolata, Sabella penicillus, Siphonostomum gelatinosum, Pectinaria belgica.*

Polyzoa.—*Pedicellina cernua,* var. *glabra, Bowerbankia imbricata, Anguinella palmata, Bugula flabellata* and *B. turbinata, Flustra foliacea, Bicellaria ciliata, Amathia lendigera.*

Pycnogonida.—*Pycnogonum littorale, Phoxichilus spinosus.*

Crustacea.—*Hyas araneus, Stenorhynchus rostratus, Porcellana platycheles, Mysis flexuosa, Caprella linearis.*

Mollusca.—*Tapes pullastra,* var. *perforans, Pholas crispata, Eolis despecta, Eolis drummondi, Eolis coronata, Eolis nana, Ancula cristata, Doto coronata, Dendronotus arborescens, Tritonia plebeia, Doris pilosa, Eledone cirrhosa.*

Tunicata.—*Ciona intestinalis, Clavelina lepadiformis.*

The specimens of *Garveia nutans* were found living, and with gonophores, on June 13th, attached to the rocks just beyond low water mark at the north end of the Island, exactly opposite the spot in Hilbre Swash where the species was dredged on the "Merry Andrew" expedition, on May 9th.

It is intended during next summer to divide the littoral

zone at Hilbre into a series of regions or sub-zones, separated by contour lines parallel with low water mark, and to investigate the fauna and flora of each region separately, so as to determine their characteristic animals and seaweeds, and the relative capacities the different species possess for withstanding exposure to air and sunshine. *Flustrella hispida* was found, last summer, attached to the rock, within about one yard of high water mark, in a living and healthy condition. From its position, this animal can only be immersed in water during a small proportion of its life, at and about the time of high tide. It will be interesting to discover whether it shares this condition with other marine animals and to determine the nature of the food in such cases, and whether the species is able to stand considerable variation in the amount of its periodic exposure to air.

On some parts of the Hilbre shore, especially at the northern end where sand and rock meet, a gregarious tubicolous annelid, *Sabellaria alveolata*, is present in great abundance, and produces, by building up tubes formed of sand-grains, a loose, porous, but crisp and brittle, mass, which crumbles when walked upon, but which is constantly being renewed, and has its injuries repaired by the living annelid within. This, from its abundance and thickness, must have a very considerable effect in protecting the shore from the erosive action of the sea. The masses, hummocks, plateaux, ledges, and small reefs of this rock-building annelid, have often a curious external resemblance, superficial only, of course, to the forms produced by coral masses amongst coral reefs and islands. It might be possible, by a continuous study on the spot of this *Sabellaria* at Hilbre, to determine what part the various factors—food, currents, muddy water, presence of sand and rock, exposure to waves, and arrangement of animals in the mass—take in producing the different shapes, and in favouring and retarding growth.

A considerable amount of variation was noticed in the relative numbers of certain species at the various expeditions to Hilbre Island. As an example, the large *Dendronotus arborescens* was almost absent from the shore early in the summer (May), while in July it occurred in abundance. This suggests that there is possibly a considerable amount of migration from deep water on to the shore, and back again, in the case of some species of molluscs and other animals.

The discovery of *Clavelina lepadiformis* at Hilbre is interesting, as the Tunicata seem particularly rare in this neighbourhood. *Clavelina* was dredged in abundance, during August, off the south end of the Isle of Man, in deep water.

In the middle of June, Mr. JAMES POOLE, a member of the Committee, offered to provide a tug, the "Spindrift," for a dredging expedition on the 20th of June. The channel between Hilbre Island and Point of Ayr, on the Welsh coast, was chosen for exploration on this occasion, and, notwithstanding very unfavourable weather, a considerable amount of work was done. Dredging, trawling and tow-netting were carried on in Hilbre Swash, in Welshman Gut, and in a deep hole lying a short distance off Point of Ayr. In this last locality, the following species amongst others were obtained:—

CŒLENTERATA.—*Hydractinia echinata, Halecium halecinum, Alcyonium digitatum, Actinoloba dianthus, Lafoëa dumosa, Sertularia abietina, Sertularia operculata, Sertularia filicula, Antennularia antennina.*

POLYZOA.—*Idmonea serpens, Scrupocellaria scrupea, Amathia lendigera, Crisia eburnea, Alcyonidium gelatinosum.*

CRUSTACEA.—*Montagua alderi, Caprella linearis, Mysis*

spiritus, *Pagurus bernhardus*, *Galathea intermedia*, *Portunus arcuatus*.

Mollusca.—*Natica catena*, *Tellina tenuis*, *Sepiola atlantica*.

Surface organisms seemed to be almost confined on this occasion to *Noctiluca miliaris*, a few Copepoda, and vast quantities of a small spherical gelatinous Alga. This last organism was met with again, later on in the summer, by Mr. Thompson, at Penmaenmawr.*

Probably the region at the mouth of the Dee, lying between Hilbre Island and the Point of Ayr, will prove a very good dredging locality, when carefully investigated under more favourable circumstances.

It was thought desirable by the Liverpool Marine Biology Committee that the marine fauna at the extreme limits of the Liverpool Bay district† should be investigated, and collections made at these places, so that comparisons might be instituted with the faunas of Hilbre Island and of the immediate neighbourhood of the Mersey. Consequently one of the members of the Committee conducted dredging and tow-netting observations for several weeks in July, in the neighbourhood of Penmaenmawr, and another member spent five weeks in July and August in continuous dredging and collecting along the southern end of the Isle of Man. For a detailed account of these observations, reference may be made to the separate Reports upon these outlying localities.‡

Several Ascidians (*Ascidia virginea*, *Ascidia scabra*, *Styela grossularia* and *Botrylloides rubrum*), which had not been previously obtained in the district, were found at Penmaenmawr.

* See *Report upon Fauna of Penmaenmawr*, p. 315.

† The western limits are the Isle of Man to the north and Anglesea to the south.

‡ See *Report on Fauna of Penmaenmawr*, by I. C. Thompson, F.R.M S., p. 315; and *Report on Fauna of Isle of Man*, by Prof. Herdman, D.Sc., p. 318.

Amongst the other more notable species observed were *Aglaophenia pluma, Vermilia triquetra, Thelepus circinatus, Amathia lendigera, Bugula flabellata, Philine aperta,* and *Pycnogonum littorale.*

The marine fauna at the south end of the Isle of Man was found to be particularly rich, and a number of rare species were collected, amongst which were the following:—

Porifera.—*Halisarca dujardinii, Hymeniacidon sanguinea, Cliona celata, Dictyocylindrus stuposus, Chalina limbata, Isodictya elegans, Halichondria incrustans, Leucandra gossei, Leucandra nivea, Leucandra johnstonii, Leucandra fistulosa, Ascetta coriacea.*

Cœlenterata.—*Garveia nutans, Campanularia hincksii, Campanularia caliculata, Plumularia pinnata, Corynactis viridis, Polythoa arenacea, Sarcodictyon catenata, Halcampa chrysanthellum, Adamsia palliata, Heliactis venusta, Bunodes gemmaceus, Bougainvillea britannica, Thaumantias octona, Thaumantias thompsoni, Tubularia simplex.*

Echinodermata.—*Antedon rosaceus, Asterina gibbosa, Ocnus brunneus, Cucumaria hyndmanni.*

Polychæta.—*Hermadion assimile, Hermione hystrix, Harmothöe haliœti, Sthenelais zetlandica, Sagitta bipunctata, Filograna implexa.*

Polyzoa. — *Pedicellina gracilis, Cellaria fistulosa, Schizoporella hyalina, Membranipora aurita, Umbonula verrucosa, Mimosella gracilis, Ætea truncata* and *Æ. recta, Mucronella coccinea, Eucratea chelata,* var. *elongata,* nov.

Crustacea.—*Proto pedata, Inachus dorsettensis, Eurynome aspera, Ebalia tuberosa, E. tumefacta* and *E. cranchii, Pagurus cuanensis.*

Pycnogonida.—*Pephredo hirsuta* (?), *Phoxichilus spinosus*, *Phoxichilidium femoratum*.

Mollusca.—*Pectunculus glycimeris*, *Lima loscombii*, and *L. elliptica*, *Pecten tigrinus*, var. *costata*, *Modiolaria marmorata*, *Fissurella græca*, *Dentalium entale*, *Trivia europæa*, *Trochus zizyphinus*, *Phasianella pullus*, *Pleurobranchus membranaceus*, *Aplysia punctata*, *Eolis picta*, *Eolis amœna*, *Eolis tricolor*, *Goniodoris castanea*. *Astarte sulcata*, *Venus casina*, *Thracia prætenuis*.

Tunicata.—*Botryllus violaceus*, *Botrylloides albicans*, *Morchellium argus*, *Morchellioides alderi*, n.sp., *Clavelina lepadiformis*, *Perophora listeri*, *Diplosoma crystallinum*, *Corella parallelogramma*, *Ascidia plebeia*, *Eugyra glutinans*, *Molgula occulta* and *Polycarpa monensis*, n.sp.

Other members of the Committee continued, during the summer, to make collections at Hilbre Island, and various points on the coast in the neighbourhood of Liverpool.

Early in October, a meeting of the Biology Committee was held at University College, when all the collections, which had been preserved and stored in the Zoological Laboratory, were inspected and roughly classified. The conclusion was unanimously arrived at, that so much new and interesting material had been brought together during the summer's work, that it was desirable that the collections should be worked up by specialists, and the results published before the next season's dredging investigations commenced. The various groups were then placed in the hands of the members of the Committee and other naturalists who had consented to take charge of them, and whose Reports compose this volume; and shortly afterwards, on October 19th, Professor Herdman, at the request of the Committee, laid

a preliminary Report upon the first year's work before the members of the Liverpool Literary and Philosophical Society.

A proposal was then made that the Council of that Society should undertake the publication of the series of Reports, as an Appendix to the annual volume of *Proceedings*, and also as a separate publication; being aided, if necessary, by grants from the other local scientific societies, and by private subscriptions.* This proposal was accepted, and the present volume is the result. All the chief groups of invertebrate animals which were collected have been reported upon, but a few of the smaller groups, such as the Rotifera, the Ostracoda, the Turbellaria, and some others, have not yet been overtaken. These, along with supplementary reports upon those larger groups which need them, and monographs upon special animals, and a report upon the fishes of the district which Mr. T. J. Moore has undertaken to draw up, will form the subject matter of a second, and possibly of several additional volumes, which will probably be published by the Committee after one or two years of dredging, and other investigations in the locality.

In order to render this Fauna of Liverpool Bay as nearly complete as possible, the species recorded by all previous investigators have been discussed along with those actually collected by the Committee. Consequently most of the Reports may be regarded as including records of all the work done upon the particular groups of animals in this District, brought up to date.

It only remains to record the numerical results of the first year's work of the Committee; for all further details the separate reports on the groups must be consulted. Prior

* A list of the subscriptions will be found on p. 371, at the end of this volume.

to 1853, investigators* in this locality, as recorded in Mr. Byerley's *Fauna*,† had discovered in all about 270 species of Marine Invertebrata. Since that date there has been no general work on the subject. The Liverpool Marine Biology Committee have to place on record altogether 913 species,‡ of which at least 235 had not been found before in the locality. Sixteen of these species have not been previously discovered in British seas, and at least seven species and three varieties are new to science.

University College, Liverpool,
January, 1886.

* For full details in regard to the work of previous observers, see Mr. Higgins' Report, p. 16.

† Appendix to vol. viii of *Proc. Lit. and Phil. Soc. of Liverpool*, 1855.

‡ Including previous records. The district investigated by the L. M. B. C. is of somewhat wider extent than that treated of by Mr. Byerley.

PIONEERS IN LOCAL BIOLOGY.

By Rev. H. H. Higgins, M.A.

The earlier workers in the field of our local Natural History, before the word Biology in its more restricted sense had come into use, or the special study for which the term now often stands was more than rarely and imperfectly appreciated, belonged to a class of observers capable of doing excellent service to the science of their own day. Take for example the aid rendered to Geology by conchological collectors. Not a few memories are warmly cherished in Liverpool, of fellow-townsmen devoted to the pursuit of natural science, whose contributions to the literature of the subject extended only to the occasional appearance of their names as donors of specimens to authorities such as Johnston, Jeffreys, Yarrell, Carpenter, Alder, Landsborough, and others.

But at the outset of a series of papers, the materials for which must to an important extent depend on the use of the marine dredge, Liverpool naturalists will be glad to be reminded that one of the first explorers of the sea-bottom for scientific purposes was a Liverpool merchant, Robert McAndrew, who, with his friend, Edward Forbes, have left undying names amongst the members and in the volumes of the British Association. Mr. McAndrew was a liberal contributor to the museums of Liverpool, and a generous promoter of every effort made to investigate the Natural History of the vicinity. His very fine collection of British and foreign Shells is now in the Museum of the University at Cambridge. It is remarkable for a large number of series illustrating the growth of shells from the nucleus, of micro-

scopic proportions, to the full-sized shell. A considerable number of the species were collected within the Liverpool Bay. Mr. McAndrew was President of the Liverpool Literary and Philosophical Society in 1855.

By far the best and most important memoir claiming to be here noticed, has been thus mentioned*:—

FAUNA OF LIVERPOOL, by ISAAC BYERLEY, F.L.S., M.R.C.S.E., Literary and Philosophical Society. Appendix to Proceedings, vol. viii., 1853–54, pp. 125.

Species, Mammalia 42, Aves 195, Reptilia 5, Amphibia 6, Pisces 100, Mollusca 181, Crustacea 70, Lepidoptera 714, Annelides 33, Acalephæ 12, Echinodermata 11, Hydrozoa 35, Anthozoa 6, Polyzoa 26, Spongia 5.

A valuable work, the best portions of which are those which were contributed mainly through Mr. Byerley's own investigations.

During the excursions of the L. M. B. C. in the summer and autumn of 1885, so small a number of vertebrate animals was collected that it was thought better to defer an account of previous work done in this department till the appearance of a second volume; more especially, since a very considerable amount of interesting materials might be collected from various sources. Long lists of Mammalia, Aves, and Pisces, are given by Mr. Byerley in his *Fauna*, often accompanied by valuable details, especially in the fishes. Our esteemed friend, Mr. T. J. Moore, Curator of the Public Museum, has given some short but valuable communications on our locally-collected vertebrate animals to the Literary and Philosophical Society. Most of these, but not all, have been noticed in the *Proceedings* of the Society. Occurrences of rare species are described in scattered records, which may possibly require careful weeding, as well as industrious finding.

* List of local papers on Nat. Hist., *L. N. F. C. Proceedings*, 1874.

Mr. Byerley's *Fauna* recorded the occurrence of more than one specimen of the bottle-headed Dolphin, *Hyperoödon;* also of the Dormouse and of the Marten.

The Mollusca of the district, land, fresh-water, and marine, are represented in Mr. Byerley's *Fauna* by a fine series of 181 species, of which 123 are marine; most of them, with many others, have been more recently taken within our area. The local workers in marine shells, most frequently quoted, are Dr. Donald Cameron, Mr. Webster of Upton Hall, Mr. F. P. Marrat, and for the shell-less marine species, Mr. John Price.

To the north of Anglesea, within our area, must be some dredging ground very prolific in the Mollusca; for about the time when Mr. Byerley's *Fauna* was printed, the writer spent three days on the sands and low rocks of Red-wharf Bay, eight miles from Beaumaris, and succeeded in collecting 84 species, an unusual number to be obtained without the use of boat or dredge.

Not long after, whilst the writer was collecting with Mr. Byerley, on Caldy Blacks, in the river Dee, one lovely midsummer's morning, betwen four and five a.m., the incoming tide, approaching from Daw-pool Deeps, cut us off, and though we rushed to our trap, and drove as rapidly as possible through the impatient stream, for a time it seemed more than likely that the horse would have to swim, and the trap be upset. I venture to recommend the members of the Marine Biology Committee, visiting Caldy Blacks during the low spring-tide of a June morning, to place a sentinel on the out-look, as a possible substitute for their own fascinated powers of attention to environments. The following species were found at Caldy Blacks: — *Venus fasciata*, a valve, *Trochus cinerarius*, *Chiton cinereus*, *Doris*, three species, *Eolis*, one species, and many Hydrozoa.

In the Crustacea, Byerley's list of 70 species includes

some which have very rarely been taken since; *e.g.*, *Nephrops norvegicus* and *Pasiphœa sivado*. The Entomostraca seem to have been chiefly collected by Mr. H. Weightman, who has recently occupied the chair of the Microscopical Society.

After enumerating 11 species of Echinodermata, Mr. Byerley next supplies a list of 35 Hydrozoa, in which for the first time prominently appears the aid of our veteran *collaborateur*, R. A. Tudor, of Bootle, who in earlier days was a valued correspondent of some of the most distinguished men in "Marine Biology," including Alder, Hancock, Landsborough, and Mr. Bean of Scarborough.

The writer has selected from the *Fauna* some remarks by Mr. Byerley, on *Actinia troglodites*, as illustrating the true spirit of a Biological Observer:—

Actinia troglodites.

Has been found in pretty good numbers upon the Leasowe shore and near Egremont slip. I have kept as many as eight or ten together for upwards of six weeks. They were very often ill-used for want of a fresh supply of sea water, but seemed to be most tolerant under the infliction. It was seldom until after having been kept for ten or twelve days in the same water that they began to droop considerably, and they were speedily restored by a change. No food was given at any time. At first they threw off a great number of germs or ova, which, before they were extruded, could be plainly seen through the external envelope, and especially at the bases of those specimens which had not attached themselves, and could be turned over for examination. It appeared quite clear to me that these germs, young actiniæ (or whatever they may be called), made their exit through breaches of continuity in the outer envelope, near its junction with the basal disk, and sometimes through ragged apertures in the base itself; in fact, I have hooked out the germs which were just on the point of emerging with a blunt probe, which was delicately used, and *did not make* the opening. The germs were about the size of a pin's head, and perfectly globular; they showed, by careful watching, a very sluggish motion. Three or four were put into a wide-necked 1½-oz. bottle, having a ground glass stopper, with sea water, and were intended for a microscopic inspection in the evening; they were quite forgotten

however, and at the expiration of two months one was found to have become developed into a perfect but very small actinia. It is now (after six months) alive, but has never increased in size; it continues closely shut up, when there is a fresh supply of water, for some days, but after a week, and from that to a fortnight, fully expands again. For this reason the water has not been changed more than six times since it has been in my possession. No pabulum of any kind has ever been given. It seems to make no difference whether the stopper is kept in the bottle or not, so far as the animal's health is concerned. These creatures were shy of expanding during the day, and then were as flat as a coin. I used always to pay them a visit before bedtime, knowing that I should be repaid by a view of their full-blown expansion during the previous darkness. The stimulus of candle light used to set their tentacula in active motion, without making them "retire for the night."

Mr. Byerley is still, and we trust may long continue to be, with us; more cannot, therefore, be said than that the author of the *Fauna* was more anxious for justice to be done to the labours of his friends than to his own; a proclivity which may account for the following sentence in the preface to the *Fauna*:—

"These remarks are made as an apology for any short-comings in this first attempt at a Fauna, the materials for which must always be receiving additions, and thus it never can be perfect. Much as I may feel on my own account, I must not dilate upon its imperfections, in justice to several industrious workers who have kindly assisted. Whilst dredging, the Rev. H. H. Higgins, Messrs. Webster, Samuel Archer, Marrat, and Cameron, afforded the greatest help; without their efforts much of the information relative to the creatures in the neighbouring waters could not have been obtained. The last-named gentleman undertook, single-handed, the not over agreeable or safe duty of dredging the Mersey."

That Mr. Byerley still continues to take a lively interest in our Local Marine Biology, is evident by a note the writer received from him, January 23rd, 1886:—

"I should be very glad if you will keep a good look out for

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INVESTIGATIONS

Noctiluca when aggregated in patches. I saw one of these at Hilbre, where they had collected together in myriads, forming a circumscribed *red* patch about four or five feet in diameter. When I put my hand into it, it came out of the water completely covered with the little globules, all of a deep pink colour, so very different from the clear hyaline aspect of them as we usually find them. Similar patches have been observed by Dr. Collingwood, and more recently; but the animals forming them were not examined. It is very desirable to know if this is a matter of not unusual occurrence, and what purpose it serves in the economy of the animal. In the Southampton water a Flagellate animalcule, *Peridinium fuscum*, I think, aggregates in the same way, but not in patches, as it is generally diffused, and continues to embrown the Southampton water from the end of July to September."

Amongst the sons of biological toil on the shores of the Mersey and the Dee no one has gained a wider reputation, or secured a larger amount of affectionate regard, than the writer's very old friend, John Price, M.A., St. John's, Cambridge, out of whose many eligible characteristics one alone shall here be noticed—his facility in finding stores of natural beauty and instruction in, apparently, the most barren scenes and objects. His "History of Birkenhead Shore" was published in ten or twelve numbers of *Old Price's Remains*, 1863-64. Only the Ctenophora can now be mentioned—*Beroë* and *Cydippe*, with which the name of Mr. Price will long be associated.

His first introduction to *Cydippe* occurred at the Woodside slip:—

"My eye fell upon a small object of transcendent brilliancy lying in a crevice on the wet stones just left bare by the ebbing tide. It looked like a pebble of the finest rock crytal, fashioned with consummate skill into the shape of a diminutive melon. After gazing on it in amazement, I took it up and found it was composed of a firm but tremulous jelly, about the size of a nutmeg, and exhibited on its eight ribs the most exquisite sculpturing I had ever seen, like the engravings of a signet. . . . Its perfect transparency was most remarkable. . . It was indeed 'a gem of purest ray serene.'"

"It is curious to think that these two gentle creatures, *Cydippe* and *Beroë*, which I encountered at such a long interval, and with which I became such good friends, proved to be mortal enemies! At least, that the *Beroë* should be the natural foe of the *Cydippe*, which she pursues and swallows, one after another (if small enough, to the number of three, four, or even five), till the ingerent and ingesta, both equally transparent, look like a gauze bag crammed with decanters! Whilst, if the victim be the larger of the two, as is very often the case, the captor will fasten on its prey like a lamprey, and take a large piece out of the side, leaving the poor unresisting *Cydippe* to sail about with cabin window wide open."

The paper on "Beroïd Babies" (*Remains*, p. 532), directs the willing observer to select, at the close of summer, "a large damaged specimen of *Beroë*" which he would reject for any other purpose, . . "and place it in a sample bottle of *very* clear sea-water; this will soon swarm with eggs." These, in his own metaphorical style, Mr. Price discourses on, especially noting that from the very first they are "so very like their own mama." Regarded as Hydrozoa, this might be noteworthy.

In the correspondence elicited by the preparation of the present paper, the writer received the following note:—

Jan. 23, 1886.

Dear Mr. Higgins,—I ought to have stated that *C. pileus* was *always* abundant at Birkenhead, *C. pomiformis* rare, *but perhaps often unnoticed*; *Berõe ovata* only occasional, sometimes tinted mauve, sometimes olive-green. *Alcinöe vermiformis* (Cuvier), which Patterson called *Bolina hibernica*, occurred twice only as *marvels!* I made fifty drawings of the first I saw! I met with several swimming past the little pier at Blairmore, on the north side of the Clyde, and caught one which *greatly* astonished Mr. Young, curator of the Glasgow Museum. It is a creature of *extraordinary* beauty, and *very* curious structure: "*vermiformis*" is a bad name, referring only to some *very* small *wriggling* tentacles, at the edge of the mouth. Look for him at the obsolete Monks' Ferry slip, south side, at half-flood or ebb. "Nature is true to herself," said Ed. Forbes, and there the creature came, *twice*, at *any*

rate. The same is a good station for *Cydippe*, and *Beroë*, and *Medusæ;* and the shore and walls are *most productive*, in great variety, A *large shabby*-looking *Cydippe* is very apt to be "in spawn," and the ova will *float*, visible to the naked eye, and may be mistaken for *Noctiluca* (see *Remains*, "Beroïd Babies.") A *rushlight* shews such objects extremely well.—Our kind regards to all. Yours truly, J. Price.

These lines will elicit heartfelt admiration and sympathy in all who know the painful circumstances under which they were written.

Mr. Price regards *Cydippe* as the most beautiful of all invertebrate living things. When *Cydippe* is seen in perfection, the writer is quite inclined to agree with the estimate of Mr. Price, who adds:—

I never *saw Beroë* take any food but *Cydippes*, nor *Cydippe* any but a very ghost-like Shrimp with staring eyes (*Mysis ?*), refusing other Crustacea. Two *large Cydippes* were dissolved away in four and a quarter hours, and then replaced by two others. *Cydippes* may be often taken with the vessels full of a milky fluid, which shews the further process of digestion admirably. The *Beroë* is too flimsy to shew this so well. The trains and cilia work briskly after being swallowed. Query—How can the *Beroë* bite a hole out of the *Cydippe* when too large to bolt?—See *Remains*.

The Liverpool Naturalists' Scrap Book.—Issued in the form of a pamphlet, with lithographic text. Sixteen monthly numbers appeared, commencing March, 1863. A copy may be consulted in the Free Public Library. A few brief extracts only can here be given:—

1. Are Shrimps nocturnal?

Their habits, as observed in aquaria, indicate that Shrimps are noctural, but Prawns diurnal animals (p. 4). Thomas J. Moore.

2. Reasons for including Flintshire in the Liverpool district. F. Archer, p. 32.

3. Hidden marine shells and the tracks they make. F. P. Marrat, p. 126.

4. *Syrinx harveii*, two or three specimens. Long and interesting

morphological and anatomical details, p. 142. Charles H. Brown, Southport. Locality, where *S. harveii* was taken, not certain.

5. Entomostracon. New to the district; described and figured by T. J. Moore, p. 216.

6. Annelid. New to the district; described and figured by T. J. Moore.

7. Alga. *Delesseria sanguinea.* Near the Alt. C. S. Gregson.

Thomas J. Moore.

Sepiola atlantica, Formby.
Clava multicornis, Dingle.
Eledone cirrhosus, Mersey, with very interesting and full details.
Portunus arcuatus. On the bar.
Mysis Chamæleon, Bootle.
Corystes cassivelaunus.

F. P. Marrat.

Marine Algae, 19. 44. 21. 10. 5. Total 99.

Mr. Marrat's Algae were found in the restricted district, and were carefully identified.

Comparatively small space is given in the Liverpool Naturalists' Scrap Book to Marine Biology. Other kindred subjects occupy five-sixths of the volume.

On June 22nd, 1865, during an expedition of the Liverpool Naturalists' Field Club in the steamer "Eblana," Mr. F. P. Marrat collected the following species of Algæ on the shores of Puffin Island, at the entrance to the Menai Straits. The names are taken from Harvey's *Phycologia Britannica :—*

Phyllophora rubens
Halidrys siliquosa
Corallina officinalis
Jania rubens
Enteromorpha ramulosa
Enteromorpha intestinalis
Enteromorpha compressa
Hydnea purpurascens
Gelidium corneum
Ceramium deslongchampsii
Ceramium rubrum
Rhizoclonium riparium
Delesseria sanguinea, very rare and bad
Delesseria sinuosa
Delesseria alata
Rhodymenia ciliata
Dumontia filiformis
Cladophora flexuosa
Phyllophora membranifolia
Cladostephus spongiosus
Cladostephus verticillatus
Porphyra vulgaris
Cladophora diffusa

Ptilota sericea
Ptilota plumosa
Ulva linea
Griffithsia setacea
Griffithsia equisetifolia
Iridæa edulis, a toru specimen
Sphacelaria plumosa, rare
Sphacelaria scoparia
Sphacelaria cirrhosa
Sphacelaria fusca
Cladophora lætevirens
Cladophora rupestris
Cladophora rudolphiana
Bryopsis plumosa
Asperococcus echinatus
Chordaria flagelliformis
Desmarestia aculeata
Gracilaria confervoides
Rhodomela subfusca
Melobesia fasciculata
Chondrus crispus

To Cuthbert Collingwood, M.A., M.B., author of *Rambles of a Naturalist on the Shores of the China Sea*, Hon. Sec. of the Liverpool Literary and Philosophical Soc., 1860–65, must be assigned a distinguished place amongst the pioneers of our local Natural History; and though his writings, attractive in style as they are, indicate a compiler and a chronicler rather than an investigator, he was a zealous worker as well as a wide and an appreciative observer.

In two papers published in the *Proceedings* of this Society, 1863–4, on the Geological Fauna and the Historic Fauna of the District, Dr. Collingwood has quoted a very large number of authorities, principally on the fossil remains or recent occurrences of vertebrate animals.

In June, 1859, September, 1860, and January, 1861, Dr. Collingwood published in the *Annals and Magazine of Natural History*, three papers on the Nudibranchiate Mollusca of the Mersey and the Dee, from which the following list is taken :—

List of the Nudibranchiata of the Mersey and the Dee.

1. *Doris tuberculata.* Mersey and Dee; common.
2. —— *johnstoni.* Mersey and Dee; once or twice.
3. —— *proxima.* Mersey and Dee; common (found nowhere else).
4. —— *bilamellata.* Mersey and Dee; abundant.
5. —— *pilosa*, Mersey and Dee; not uncommon.

6. *Doris subquadrata.* Dee; once (the second known specimen).
7. —— *depressa.* Dee; once.
8. *Polycera lessonii.* Between Mersey and Dee; once.
9. —— *ocellata.* Mersey and Dee; occasional.
10. *Ancula cristata.* Mersey and Dee; common.
11. *Tritonia hombergii.* Mersey and Dee; occasional.
12. —— *plebeia.* Mersey and Dee; occasional.
13. *Dendronotus arborescens.* Mersey and Dee; common
14. *Doto coronata.* Mersey and Dee; very common
15. *Eolis papillosa.* Mersey and Dee; common.
16. —— *coronata.* Mersey and Dee; common.
17. —— *drummondi.* Mersey and Dee; very common.
18. —— *rufibranchialis.* Mersey and Dee; not uncommon.
19. —— *landsburgii.* Mersey and Dee; rare.
20. —— *concinna.* Mersey; common (the second known locality).
21. —— *olivacea.* Dee; once taken.
22. —— *aurantiaca.* Mersey and Dee; common.
23. —— *picta.* Mersey and Dee; not uncommon.
24. —— *exigua.* Mersey; apparently rare.
25. —— *despecta.* Mersey; common.
26. *Embletonia pallida.* Mersey (the only known locality): very rare.
27. *Antiopa cristata.* Dee; occasional.
28. *Antiopa hyalina.* Dee (the only known locality); very rare.

All these papers are excellent, but, in the *Annals*, they are so thoroughly within easy reach of students that any lengthened reference to them would be needless in the present paper. But let those who feel inclined to study this beautiful group by all means read these three papers in the *Annals*. It is truly refreshing to find objects of natural beauty exciting a freshness of enthusiasm that is easily lost but impossible to be recovered.

About the same time, 1859, John Baker Edwards, Ph.D., F.C.S., read a paper before the Literary and Philosophical Society, on "The Marine Animals of the Mersey Shore," with especial reference to the management of marine aquaria for the study of the habits, life-histories, and physiology of

our local species. Dr. Baker Edwards was a very energetic and successful worker in aquaria, thus becoming a pioneer in an advanced department of our local Biology.

The Liverpool Naturalists' Field Club, since its establishment in 1860, has held many expeditions for dredging, and excursions to various parts of the coast. At the close of each year, prizes in the form of books on Natural Science are given to the most successful collectors. Two prizes have been gained in Algæ, two in marine shells, and two in Hydrozoa and Polyzoa. In the latter classes, the collection made by Mr. and Mrs. Howard Chapman, wholly from specimens found on the shore, was remarkably good, and contained many rare forms.

The Chester Society of Natural Science has published its *Proceedings* in three parts, well worthy of the scientific work they represent, which does honour to the distinguished founder of the Society, Charles Kingsley, Canon of Westminster.

Dr. Henry Stolterfoth, M.A., in *Proc. C.S.N.S.*, Part 2, 1874, gives a List of Diatomaceae found in Chester and the district, and Cwm Bychan, N.W. Very many of the species were collected in the estuary of the Dee. The list is copious, and occupies twelve pages. Fifty-eight genera are included, of which *Navicula* alone is represented by eighty species. The same author contributes to Part 3, a paper on "Surface dredging on the Dee." The paper describes many special forms of microscopic life found on the surface of the estuary of the Dee, with the author's method of collecting them.

Mr. J. D. Siddall has contributed to Part 2 an excellent paper on the Foraminifera of the River Dee. About 134 species are recorded, and Mr. Siddall makes some valuable observations upon the living Foraminifera.*

* See Mr. Siddall's "Report upon the Foraminifera of the L. M. B. C. District," p. 44.—Ed.

Mr. A. O. Walker, F.L.S., although one of the most thorough-going of our local Pioneers in Marine Biology, has given his name less frequently than his valuable assistance. In the opening pages of Part 2, *P.C.S.N.S.*, occurs a short paper of his, entitled, "Observations on Phenomena connected with the deposition of Sediment at the present day in the estuary of the Dee, and their bearing upon older deposits." It is a short paper, but leads to results higher than even the finding of rare or undescribed species. Very little has been done locally in the philosophy of life at the bottom of the sea.

Free Public Museum of Liverpool.

The specimens now exhibited in the table cases as British representatives in the six groups assigned to Sertularian and allied Zoophytes, and to the Polyzoa, were, with few exceptions, collected on the shores of the Mersey and the Dee, by the Rev. Henry H. Higgins, and were by him presented to the Museum, together with many of the exhibited British representatives of the Marine Mollusca.

Liverpool Naturalists' Journal.—Published in connection with the Liverpool Naturalists' Field Club. Printed in monthly numbers, of which 20 appeared, commencing June, 1866.

It was designed to be "an organ by means of which naturalists might record their observations and communicate their ideas for their common benefit."

The Journal contains about 120 communications, which, though not confined to local natural history, include much information on the subject. Amongst the contributions of a more general character may be mentioned a valuable series of papers on the "Development of Plants," by J. B. Nevins, M.D., and various articles by F. Archer, Jun. A copy may be consulted in the Free Public Library of Liverpool.*

* List of local papers on Nat. Hist., *L.N.F.C.*, H.H.H., 1874.

No. 5, p. 77. I. Byerley. Spontaneous fission in *Anthea cereus* and *Sagartia candida*. The latter into four fragments. The writer noticed indications of a similar action in a stony coral, *Halomitra*, but is unable to recover the paper in which the phenomenon is described.

No. 14, p. 155. I. Byerley. Tenacity of life in the cilia of a mussel, and in a *Littorina*.

T. J. Moore. Cuttle-fish, *Sepia officinalis*, from Burbo Bank.

No. 16, p. 174. W. Banister. Habit in *Dianthus plumosa*, of throwing off mucus when irritated.

The communications made to the *Liverpool Naturalists' Journal* were almost entirely botanical.

Transactions of the Historic Society of Lancashire and Cheshire.

A considerable number of papers on local Zoology and Botany may be found scattered in these Transactions; very few, however, relate to the special subject of the Report.

Thomas Comber. *Trans.*, vol. xi, 1859.

"List of Diatomaceae found in the vicinity of Liverpool." Mr. Comber offered this paper as a contribution to the Flora of Liverpool, already fairly represented in most of the other groups. The list contains 257 species, included in fifty-one genera, and has been named and arranged after W. Smith. Mr. Comber mentions as his fellow-workers, G. Mansfield Browne, T. Sansom, and L. Hardman.

Richard A. Tudor. *Trans.*, vol. viii, 1856.

"General Remarks on the Natural History of the Shores of the Mersey." Mr. Tudor's name occurs in the *Annals*, and in the volumes of the Ray Society as a correspondent and fellow-worker with the distinguished authors of Monographs, but his published remains are so uncommon that the

writer was gratified in finding some short extracts from the above-named paper.

"In many patches, nearer to high water mark, on the shore, may be observed millions of worm casts. These are produced by the lob or lug-worm. A few inches from the cast may invariably be seen a round hole, through which the animal came and fed while the tide covered the surface; and the cast is deposited after the nutritious portions have been extracted. These creatures are very much sought for by fishermen, and when first taken, they display the prismatic colours very beautifully by their movements. The rings of the head of this animal are very peculiarly constructed, forming a regular cone, which it has the power of drawing in and extending as circumstances require. In these localities the ripple marks, formed by the recent action of the water, present very beautiful appearances, and the shade produced by the varying altitude of the sun cannot but attract the attention of the observer. They partake of great similarity in shape and character."

On February 3rd, 1886, the writer received a note from Mr. R. A. Tudor, who speaks of having collected on the shores of the Mersey, with Mr. Johnson, Curator of the Royal Institution; and in the Isle of Man, with Professor Edward Forbes. Mr. Tudor has now entered his 89th year.

The following table is a Report* drawn up by Mr. Byerley and Dr. Collingwood, in behalf of a Dredging Committee of the Estuary of the Mersey, appointed by the British Association, at the Oxford Meeting, 1860.

NAMES OF COMMITTEE.

Dr. J. Gwyn Jeffreys.	Isaac Byerley.
Dr. C. Collingwood.	Dr. J. B. Edwards.
Rev. H. H. Higgins.	Thos. J. Moore.

The writer's desire to collect together as many as possible of his old Natural History friends, some of them very old friends, yet all, with two exceptions, still living, arose from his recognising the issue of the present volume as epoch-making in the study of the Fauna of the Liverpool Bay.

* From *Brit. Assoc. Report* for 1861.

	Mersey and Dee, &c.	Proportion, about	British.	Characteristic or dominant species.	Rare and remarkable species.
	Species.		Species.		
MARINE FISH.....	79	1/3	216	Lesser Weever, Unctuous Sucker, Armed Bullhead, Sand Lance, Spotted Dog-fish, &c.	Sturgeon, Angler, Lump-sucker, Gemmeous Dragonet, Opah, Angle-fish (*Squatina*), Torpedo, Anglesey Morris, &c.
CEPHALOPODS	6	1/2	13	Sepiola atlantica	Octopus vulgaris, Rossia.
GASTEROPODS :—					
Prosobranchiata..	31	1/7	219	Littorina littorea, Rissoa ulvæ, Purpura lapillus, Buccinum undatum.	Rissoa vitrea, Lacuna crassior, L. vincta.
Opisthobranchiata	5	1/5	24	Cylichna obtusa	Bullæa aperta.
NUDIBRANCHIATA	28	2/7	100	Doris bilamellata, D. proxima, Dendronotus arborescens.	Antiopa hyalina, Embletonia pallida, Doris subquadrata, Eolis concinna.
LAMELLIBRANCHIATA..	46	1/4	166	Mytilus edulis, Cardium edule, Tellina solidula, Mya truncata, Pholas crispata, P. candida.	Montacuta, Artemis, Venus ovata, Crenella marmorata.
TUNICATA	4	1/18	73		
CRUSTACEA :—					
Brachyura	10	1/4	41	Portunus depurator. Carcinus mænas.	Gonoplax angulata. Corystes Cassivelaunus.
Anomoura	4	1/5	20	Pagurus, Porcellana longicornis.	Galathea Andrewsii.
Macrura	7	1/7	46	Pandalus annulicornis. Crangon vulgaris.	Pasiphæa sivado.
Amphipoda	But few.				
Stomapoda					
Isopoda.....					
ENTOMOSTRACA	9				
ANNELIDA	About 18	genera.	.....	Amphitrite ventilabrum.	
ECHINODERMATA	11	.....	.....	Uraster rubens, Ophiocoma rosula..	Cucumaria communis.
POLYZOA.....	21	1/8	.....	Gemellaria loricata, Alcyonidium gelatinosum.	
HYDROZOA :—					
Corynidæ.....	7	.....	.....	Tubularia indivisa.	
Sertulariadæ	19	1/2	44	Sertularia pumila, Plumularia falcata	Sertularia Margareta.
Campanulariadæ	7	1/4	28	Laomedea gelatinosa.	
Acalephæ.....	.....	.....	.....	Cydippe pileus, Cyanæa, Aurelia	Velella spirans.
ACTINOZOA	.....	.....	.....	Tealia crassicornis. [aurita.	Actinia mesembryanthemum.
SPONGES	Few.	.....	.....	Halichondria panicea.	

On SHALLOW WATER FAUNAS.

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Animals may be classed according to their habitat as terrestrial or aquatic, and the latter subdivided into fresh water forms and marine forms. The marine fauna, again, falls very naturally into three main groups,—the shallow water and shore animals, the deep-sea animals, and the pelagic or oceanic animals.

The entire animal kingdom may thus be divided into five groups; and, although it is impossible to separate these by sharp boundary lines, and an animal may in the early stages of its existence belong to one group, and when adult to another, yet the division is very generally accepted as a real and natural one, and it is both possible and profitable to enquire into the general characters of the several groups, and to attempt to determine their mutual relations.

I have chosen shallow water animals as the subject of the present paper, because it is with these that the Liverpool Marine Biology Committee will be chiefly concerned; and I propose to confine myself to the general characters of the shallow water fauna, and its relations to the other great groups. The application of these general principles to the special features of the area with which the Committee is occupied will, I think, be wisely postponed until further knowledge and experience of its fauna have been acquired.

The materials for the preparation of this paper are mainly derived from the reports of the various dredging and exploring expeditions which have been sent out by our own and other governments during the last twenty years. To the writings

of Professors Moseley and Semper I am under very special obligation.

The shallow water fauna is found in the greatest profusion, and in its most characteristic form, between tide marks, and at depths extending from low water level down to about fifty fathoms. From fifty to two hundred fathoms it occurs in less typical condition, and below the latter depth passes gradually into the deep sea fauna.

The most marked features of this shallow water fauna are the great profusion and variety of forms which it presents. Representatives of nearly every one of the great groups of animals occur, and the actual number of species very greatly exceeds that of the other ocean faunas.

As regards environment, the chief point is its extreme variability, which stands in the most marked contrast with the almost absolute uniformity of external conditions affecting the deep sea fauna. Thus, animals living between tide marks are exposed daily, and may spend half their lives in and half out of water, while both they and animals living at rather greater depths are subject to changes of enormous violence at times of storms. Again, shallow water animals, especially those that are periodically exposed, are liable to considerable variations of heat and cold, and of light and darkness.

The varying nature of the sea-bottom, whether rock, sand or mud; the proximity of great rivers, or other causes that may modify the quality of the water; and the various changes effected round the coasts by human agency, all help to swell the list of causes that render the environment of shallow water animals singularly inconstant. Another special feature is the abundance and variety of plant life, affording a copious supply of food denied to the inhabitants of deeper waters. The actual bathymetrical distribution of plants is less accurately known than that of animals, but the ordinary seaweeds do not extend below fifty fathoms, while below

two hundred fathoms vegetable life almost completely disappears.

This extraordinary variability in the external conditions of life is undoubtedly the great cause of the extreme diversity shown by the fauna exposed to it, and is perhaps best realised by comparing it for a moment with the environment of the deep sea fauna. Here we have animals living for the most part in absolute darkness, in water that is never more than a few degrees above the freezing point, on a sea bottom that is perfectly uniform over areas of very great extent, and largely dependent for food on other animals which, having died at or near the surface, have slowly sunk to the depths below.

Turning now to the special characters of the shallow water animals themselves, perhaps the most general feature they present is the power of fixing themselves in, or to, the sea bottom in order to resist the tides and storms, which would otherwise destroy them, or carry them out to sea.

This fixation is brought about in very various ways. It may be either a temporary one, such as is effected by the muscular foot of a limpet or chiton, or by the base of a sea-anemone; or a permanent one, as in barnacles, oysters, ascidians, etc., where the animal is immoveably attached to rock or other firm support.

In other cases, the requisite anchorage is obtained by burrowing in the sand or mud of the shore or sea bottom. These burrows may be simple holes, such as those made by many bivalves, or may be lined by tubes secreted by the animal. Similar tubes may be formed for protection by animals that do not burrow, and are then attached to foreign bodies, either by their basal ends, as in many hydroid zoophytes and worms, or along their entire length, as in *Serpula*.

It is a very noteworthy fact that, in all cases in which the

adult is attached, and these include a large proportion of the shallow-water fauna, the animal in the early stages of its existence leads a free swimming life, and is often entirely unlike the parent in appearance and structure. This fact, which will be referred to again further on, is to be regarded as evidence of the strongest kind that the attached condition is a secondary one, acquired in accordance with the habitat of the animal; in other words, that the attached forms are descended from free-swimming ancestors.

A large number of these attached forms, especially in the more lowly organised groups, e.g., Sponges and Cœlenterates, have the power of reproducing asexually, as well as by means of eggs, the asexual process being usually one of budding. A bud is commonly a hollow process of the body wall of the parent, which gradually increases in size and complexity until it becomes a second animal in all respects like its parent. It may then either separate and become a distinct animal, or, as is more usually the case, may remain permanently attached to, and in communication with the parent. Both the bud and the parent may give rise to fresh buds, and in this way a "colony" is formed, this being the name given to such an aggregation of individuals formed by budding, and remaining organically connected together.

Such colonies are not confined to the shallow-water fauna, but are far more abundant and more varied there than in either the deep sea or the open ocean, and hence may be very suitably considered in this place.

From their mode of formation, described above, it follows that the several members of a colony are fundamentally equivalent to one another. In the simpler forms they remain all alike, and, although organically connected with one another, still practically independent. Examples of such colonies are presented by many of the Polyzoa,

which form flattened leaf-like colonies, either growing independently, or encrusting the surface of rocks or seaweed. In Sponges, the connection between the several individuals of a colony is a more intimate one, and it is usually impossible to determine the boundaries of the several component members, which are blended indistinguishably with one another, and traversed by a common canal system serving for the nutrition of all alike.

In other cases, as in the hydroid zoophytes, and to a less extent in the sea-pens and other corals, the several members of the colony, though retaining their essential similarity, become modified in various ways so as to better adapt them to fulfil some one or more functions. As this can only be done at the expense of other functions, a certain amount of mutual dependence is at once set up; and, in many instances, this differentiation is carried so far that certain individuals of the colony are alone able to digest food, which they do for themselves and for all the others as well. Of these latter, some members are specially modified for capturing prey, others are either actively or passively protective in function, while to others is assigned the formation and ripening of the eggs.

The structural differences between the several members of such a colony are as marked as the functional, and it is often only by tracing their development that their essential identity can be established. The egg-bearing members of the hydroid colony usually take the form of jelly-fish or medusæ, which not unfrequently separate from the colony when ripe, and lead a free swimming existence for a time.

Of the shallow water fish, many, as the pilchards, whitebait, etc., go about in large shoals; but perhaps the most interesting are the Pleuronectidæ, or flat-fish, such as the turbot, plaice, sole, etc. In these, the body is very much compressed laterally, and the two sides are differently

coloured, one being white and the other variously tinted, according to the nature of the sea bottom. The fish when at rest lies on the white side, which in most flat fish is the left, and so exposes the coloured side only. By flapping movements of the fins it is able to bury itself more or less completely in the sand of the sea bottom, and further protection is afforded by the colour of the exposed surface changing until it resembles very closely that of the bottom on which it is resting. This power of changing colour depends on varying degrees of contraction and dilatation of certain pigmented cells in the skin—the chromatophores. It appears to be an entirely involuntary action, and does not occur in animals that are blind.

The same power is exercised in a still more marked degree, and here apparently voluntarily, by the Octopus, a shallow water animal, living in holes in rocks, and able by its great strength and the powerful suckers with which its arms are provided to successfully resist the tidal action of the waves.

Returning to the flat-fish, the most curious feature in their organisation is the fact that, in accordance with their habit of lying on one side, both eyes are situated on one side—the coloured one—of the head. When quite young a sole swims vertically with its back up, and has its eyes one on each side of the head. Very soon it acquires the habit of swimming and lying on its left side, and in accordance with this the head becomes twisted so that the left eye is brought over to the right side, and both eyes can be used when the animal is lying at rest at the bottom.

There can be no doubt that flat-fish are descended from more ordinarily constituted fish with their eyes one on each side of the head, and in the above history we have an excellent illustration of the Recapitulation Theory, which explains the early developmental stages and metamorphoses

of animals as due to a tendency to recapitulate in their individual development the characters of their ancestors.

Turning now to the relations of the shallow water fauna to the other faunas, we find that, though animal life is present on the bottom of the ocean at all depths, yet that it is not nearly so abundant at extreme as at moderate depths.

Concerning the deep-sea animals, we find the fauna is a very miscellaneous collection, including representatives of all the main groups of animals. We find further, that although some of the deep sea forms, notably the curious group of Holothurians known as Elasipoda, are more primitive than their shallow water allies, yet that this is not true of the deep sea fauna as a whole. Indeed, of the more archaic or primitive forms in existence at the present day, some, as *Limulus*, *Amphioxus*, the Ganoids, and the Dipnoi, are either shallow water or fresh water forms; while those that do occur in deep water, such as Pentacrinoids and Brachiopoda, are found in shallow water as well.

The general conclusion, then, to which we are led is that the deep sea fauna is not, as was once supposed, an essentially primitive one; that there is no evidence of the shallow water fauna having been derived from it; but that, on the other hand, the actual facts are much better explained by supposing the deep sea fauna to consist of forms that have been driven down from shallow water, by the struggle for existence, to regions where opportunities for bettering themselves are indeed not so great, but where competition is less keen.

A final argument may be derived from the supply of food. The deep sea has no ultimate supply of food in itself, for, as we have seen, plant life is unknown in it. Hence it is impossible that a deep sea fauna should have existed before a pelagic, or else a shallow water, fauna and flora had become well established.

The relation of the shallow water to the terrestrial fauna is an interesting one, but cannot be considered here in detail. It appears to have been of a give and take nature, for while on the one hand certain marine animals, such as crabs, have left the sea and become adapted more or less completely to a terrestrial habitat; on the other, *Onchidium*, a slug found on the shores of the Pacific and Indian oceans, and which by its whole organisation shows its descent from land slugs, is certainly no solitary example of a terrestrial form that has become more or less completely marine.

The mutual relations of the shallow water and fresh water faunas are of much greater importance. Geologically considered, the land is far less constant than the sea, and there are probably few spots on the earth that cannot be proved to have been under water at least once. It hence follows that the terrestrial and fresh water faunas are most probably derived from the more constant marine fauna, and in most cases presumably from the shallow water fauna, as being that immediately adjacent to the land.

In the case of the fresh water hydroid, *Cordylophora*, this migration from a marine habitat can actually be traced historically, and in the case of those fish, as the salmon and lamprey, which are partly marine and partly fresh water, such a derivation may be regarded as proved.

The general characters of the fresh water fauna entirely bear out this view. Of the great groups of animals the Echinoderms are absolutely unrepresented, and the Sponges and Cœlenterates have not half-a-dozen fresh water genera between them. The other large groups are all present, but many important divisions of them, as the Cephalopoda and Tunicata, are completely absent. Here, very much as in the case of the deep sea fauna, certain members of most of the groups seem to have worked their way from the sea up the rivers, the determining causes being the same in the

two cases, *i.e.* the possibility of obtaining new supplies of food, and of escape from enemies.

One of the most characteristic features of fresh water forms, as compared with their marine allies, is the large size of the eggs of the former. Thus, a crayfish, though but a third of the length of a lobster, has actually larger eggs. The explanation of this is probably to be found, as Professor Sollas has suggested, in the following considerations.

The effect of increased size of the egg is that the young, having a larger supply of food in the egg itself, hatch of larger size and greater perfection of development than would be possible were the egg smaller. Hence, in forms with large eggs, the earlier larval stages will be passed in the egg before hatching. This is of special advantage in the case of fresh water forms, firstly, because larval forms of very small size would be unable to withstand the currents in the streams and rivers in which they dwell, and so would be carried down slowly but surely to the sea; and secondly, because these earlier larval forms representing stages prior to the acquisition of a fresh water habitat, would not be suited to it, and might very conceivably be unable to live in it.

These considerations offer a ready explanation of such points as the passing of the early stages of development in the gills of the mother in the case of the fresh-water Anodon, and the subsequent attachment of the glochidia larvæ to fish, until they have attained sufficient size and strength to withstand the currents of the streams they inhabit.

Finally, the relation of the shallow water to the pelagic or oceanic fauna remains to be considered, and on this point it is very difficult to speak with certainty.

On the one hand, we find that in the pelagic fauna a comparatively small number of groups are represented. Sponges and Echinoderms are absent; there are but few pelagic worms, and of Arthropods, Molluscs and Vertebrates, only

certain groups have pelagic members. These facts, taken in conjunction with the further fact that pelagic animals are, as a rule, highly modified in accordance with their habits, point strongly to the pelagic fauna being a derived, and not a primitive, one; and if this be true, they must be derived from the shallow water fauna, which would thus become the most primitive of the faunas, and the parent of all the others.

On the other hand, we have the fact, already alluded to, that the larvæ and young of almost all marine animals are free swimming, and if these represent ancestral forms, as by the Recapitulation Theory we are compelled to suppose they do, then we must conclude that the ancestors of all marine animals were free swimming, presumably pelagic forms. It seems scarcely possible to regard these larval forms as secondarily acquired, and hence the conclusion to which we are led is that, while existing pelagic animals have probably with few exceptions acquired pelagic habits secondarily, yet that the most primitive animals were primarily pelagic, and that from them have sprung the shallow water fauna, from which in turn the others have been derived later on.

REPORT upon the FORAMINIFERA of the L. M. B. C. DISTRICT.*

By John D. Siddall, *Chester.*

For the preparation of the following Report very little *new* material has been examined; but a careful revision has been made of work done previously, more particularly that for the compilation of a list of the Foraminifera of the River Dee.† This river is included within the district, therefore the forms found there are also included in the list given below. With his usual great kindness, Mr. H. B. Brady revised the Dee list, and carefully examined the whole of the examples referred to therein. As might be expected, the naming of a large series of organisms obtained in brackish-water, but whose natural habitat is the sea, was a matter of very considerable difficulty. Under such altered conditions the various forms do not always attain to their full development, either in size, or substance, or characteristic form. Further, also, the examination of the River Dee was most carefully and thoroughly done. Several years were given to the work, and consequently single examples of many interesting species were found. Several of these were new to British seas; a few had only been known previously as fossil forms—one was altogether new to science. Some few were so much modified in form that their nomenclature was a matter of considerable uncertainty. In such cases, the name given could, of course, only be considered as possibly right, but not beyond doubt. I have, therefore, very carefully re-examined the examples then obtained, and have compared them with the figures

* The limits of this district are—first, a line from the Isle of Man to the opposite coast of Lancashire; second, a line from the Isle of Man to Holyhead (see Chart, Pl. XI).

† Proceedings Chester Society of Nat. Science, part II, 1878, Chester.

and descriptions given in Mr. Brady's splendid monograph on the Foraminifera collected during the cruise of H.M.S. "Challenger." The thorough and comprehensive character of this publication will render comparatively easy all future work upon Foraminifera. From the knowledge gained by the examination of such large series of examples, Mr. Brady has re-classified and arranged the Foraminifera, and has considerably modified their nomenclature. I have not hesitated to adopt fully all these changes. This will account, in part, for the differences between the list above referred to and that appended below. The same fact must also be borne in mind when comparing the lists of forms occurring in Dublin Bay and not in Liverpool Bay, and *vice versâ*, some few of them being mere differences of name, Messrs. Balkwill and Wright's list of "Recent Dublin Bay Foraminifera,"* having been published just prior to the "Challenger" volumes.

Material for examination has been obtained chiefly by scraping the sand or mud in the most promising-looking places between high and low water marks. The most prolific gatherings have been obtained at the following points :—

A sandbank opposite the old Cheesestage at Chester.
A sandbank opposite the wharf at Saltney.
A sandbank opposite Connah's Quay.
Tide pools on muddy shore at Holywell.
Between the rocks at Hilbre Island.
The shore, Isle of Man.
Stony shore, laminarian zone, Llandulas Point.
Muddy and stony shore, laminarian zone, Colwyn Bay, near Little Ormes Head.
Under the pier, Llandudno.
The Conway shore of Great Ormes Head.

* Vide *The Transactions of the Royal Irish Academy*, vol. xxviii, March, 1885.

The material from the above localities has been collected and dried as usual, and the shells separated in the main by the process of "floating;" but several of the rarer species have been obtained by the re-examination of such material as refused to float at all.

Dredgings have also been made at various points in the River Dee; off Rhyl; in Colwyn and Llandudno Bays, and the Menai Straits; and the material examined as usual; but not one example has been obtained in this manner which has not also been found in shore gatherings. I do not mean to infer by this statement that dredging is not likely to add to the list; on the contrary, I think it is from such sources that any additions of importance are likely to accrue. A glance at the comparative lists of Dublin Bay, the material for which was obtained *chiefly* by dredging, and Liverpool Bay will be instructive in this respect.

Surface dredgings have yielded absolutely nothing. The estuary of the Dee teems at times with Diatoms and other floating microzoa, and the tow net on such occasions, is soon thickly coated with them. It is the same off Rhyl, Colwyn and Llandudno; but Foraminifera are conspicuous by their absence. The experience of collectors in other seas proves beyond doubt that certain species of Foraminifera are almost exclusively pelagic when living; but such is not the case with our comparatively shallow water British forms. I have obtained alive, and kept in bottles, and repeatedly examined specimens of most of the types of Foraminifera enumerated in the following list; but these have invariably been got from the mud at the bottom of shore pools of greater or less depth. Under the influence of the sunlight, the Diatoms and other Algæ which grow in the mud at the bottom of such pools, often rise to the surface in patches. These act as rafts, and carry the Rhizopoda up with them. Once up, the outspread pseudopodia enable even the largest and heaviest forms we

get in our district to float perfectly. I have seen a shore pool at Holywell covered quite thickly with *Polystomella striato-punctata* (the commonest form in the Dee), its reddish coloured sarcode rendering it easy to distinguish on the surface of the water.

So little is even yet known of the life history of the Rhizopoda, that it seems of some importance to know where and how to obtain living specimens for study, and how best to separate and keep them. They may always be got by carefully scraping the surface of the velvety brownish mud at the bottom of pools left by the tide ; or by skimming the top of the water, if this mud be found to have risen under the influence of sunlight. The oozy mud may be got rid of by washing through a fine muslin net, and the residuum put into small bottles filled with sea water. The bottle should be kept uncorked in a cool place, out of direct sunlight, when the Foraminifera will creep up the bottle sides, and live there for months. They are readily transferred by means of a fine pointed camel hair pencil to a slide or cell for microscopical examination.

The great abundance of the dead shells of Foraminifera in and upon the sand banks of the Dee, even as high up as Chester, eighteen miles from the sea, is due to the tide, the "bore" of which collects them from the banks near the mouth of the river. The frothy scum which floats with the tide contains large numbers of forms ; but no living specimens have ever been found so far from the sea. These shells are deposited in streaks, and between ripple marks, upon the banks by the receding tide; beautifully clean and prolific gatherings being always obtainable from these places.

I can offer no detailed information respecting the Rhizopodal fauna of the River Mersey. Beyond an occasional scraping of the sands at Eastham and at New Brighton, and the observation of numerous Foraminiferal shells in both

places, I have made no attempt at an examination of that part of the district.

Details as to localities and relative frequency of occurrence of the various species enumerated are appended below in a tabular form; and more extended notes are given upon some of the most interesting forms. The references in the table are to the plates and figures in Mr. Brady's "Challenger" monograph. In the few instances where no figure is there given I have given a reference in the extended notes.

The list includes 162 species and varieties, of which three species are now for the first time named and figured. Messrs. Balkwill and Wright's list of Dublin Bay Foraminifera enumerates 148; 112 of these are to be found in both lists. The forms found in one locality, but not the other, are as under:—

Foraminifera included in "Dublin Bay and Irish Sea" list, but not yet observed in the "L. M. B. C. district."

Biloculina ringens, var.
Miliolina tenuis.
Ophthalmidium carinatum.
Cornuspira foliacea.
Haplophragmium glomeratum.
" *pseudospirale.*
" *agglutinans.*
Trochammina inflata, var.
Textularia gramen.
" *globulosa.*
Spiroplecta biformis.
Gaudryina filiformis.
Bulimina subteres.
Bolivina textilarioides.
" *dilatata.*
Lagena lineata.

Foraminifera included in the "L. M. B. C. district," but not yet observed in "Dublin Bay and Irish Sea."

Lieberkühnia wageneri.
Shepheardella tæniformis.
Gromia dujardinii.
" *oviformis.*
Squamulina lævis.
Nubecularia lucifuga.
Biloculina elongata.
Spiroloculina excavata.
Miliolina boueana.
" *venusta.*
" *spiculifera*, n. sp.
Ophthalmidium inconstans.
Dendrophrya radiata.
" *erecta.*
Haliphysema tumanowiczii.
Reophax findens.

Lagena curvilineata, n. sp.
" *crenata*.
" *lagenoides*.
" *carinata*.
" *castrensis*.
Nodosaria raphanus.
" *consobrina*.
Lingulina carinata.
Rhabdogonium tricarinatum.
Vaginulina linearis.
Polymorphina fusiformis.
" *rotundata*.
" *myristiformis*.
Globigerina inflata.
Pullenia quinqueloba.
Discorbina bertheloti.
" *wrightii*.
" *parisiensis*.
Pulvinulina karsteni.
" *menardii*.
Gypsina vesicularis.
Nonionina pauperata, n. sp.
boueana.
Reophax moniliforme, n. sp.
" *nodulosa*.
Placopsilina bulla.
" *kingsleyi*, n. sp.
Textularia agg. var. *porrecta*.
" *variabilis*.
Bulimina elegans.
" *squamigera*.
Bolivina pygmœa.
" *œnariensis*.
Lagena lyelli.
" *gracillima*.
" *apiculata*.
" *distoma*.
" *lucida*.
" *ornata*.
Polymorphina æqualis.
" *communis*.
" *thouini*.
" *lanceolata*.
Uvigerina canariensis.
Sphœroidina dehiscens.
Spirillina margaritifera.
" *limbata*.
Discorbina ochracea.
" *biconcava*.
" *turbo*.
Truncatulina haidengerii.
" *ungeriana*.
" *refulgens*.
Pulvinulina repanda.
" *canariensis*.
Nonionina asterizans.
" *umbilicatula*.

Notes on Liverpool Bay Foraminifera.

Lieberkühnia wageneri, Claparède.

Claparède and Lachmann, *Etudes sur les Infusoires et les Rhizopodes, Geneva*, 1850-1861.

Carpenter, *Introduction to the Study of the Foraminifera.*

Siddall, *Quarterly Journal of Microscopical Science*, April, 1880, pl. xvi, figs. 8-12.

This very interesting Rhizopod is occasionally quite common in Colwyn Bay. The delicacy of the membranous "test" is such that the organism is quite unrecognisable when dead. But if small colonies of living Polyzoa or Hydrozoa be placed in glass bottles in clear sea water, and allowed to stand undisturbed for a few days (even weeks sometimes), this and many other Rhizopoda may frequently be obtained from the sides of the bottle, from whence, as already stated, they are easily transferred to a trough or slide for microscopical study by means of a camel hair pencil, the point of which has been reduced to but a few hairs, or by a small pipette. The early spring I have always found to be the best period of the year to obtain these or other living Rhizopoda.

The very fine specimen of *Lieberkühnia* which I have figured as quoted above, was mounted in glycerine jelly prior to drawing fig. 12, which is a representation in optical section, × 1,000 diameters, showing, besides other parts, the transparent integument beset by short rod-like spicules. The presence of these led Dr. Carpenter, in the latest edition of his *Microscope and its Revelations*, to suggest that this was not the typical species. But I find that the spicules are due to a crystallisation from the mounting medium. They are not present on the many living examples I have examined since.

Habitat.—Colwyn Bay, near Little Orme's Head, on Algæ and Hydrozoa, &c., from low water.

Shepheardella tœniformis, Siddall.

Siddall, *Quarterly Journal of Microscopical Science*, April, 1880, pl. xv, xvi.

The "test" of this remarkable form, as in the last species, is only membranous; and this may account for the fact that no record, except the above, has ever been made of its appearance in British or foreign seas. The only way to obtain it is by searching on the sides of bottles in which have been kept the finer marine Algæ and Hydrozoa, &c. From such a source I obtained last year, in examples from Colwyn Bay, a specimen which measured two inches in length when stretched out on the bottle side. It looked just like a very delicate pale yellow hair, from each end of which was extended a ramifying network of vigorous pseudopodia. This specimen, after examination, I mounted and still have in my cabinet.

Habitat.—On Hydrozoa, &c., dredged in Colwyn Bay. Frequent in spring at Tenby.

Gromia dujardinii and *G. oviformis*.

Gromia oviformis, Dujardin, 1835. *Ann. des. Sci. Nat.*, sér. 2. vol. iii, p. 313, and vol. iv, p. 345, pl. 9, fig. 1.

Gromia dujardini, Max Schultze, 1854. *Ueber den Organ. Polythal.*, p. 55, pl. 7, figs. 1-7.

Although generally distributed among shore Foraminifera, *Gromia* is, so far as my observation goes, more at home in brackish water than in the sea. In the tide pools left upon the muddy shore of the Dee, near Holywell, I have on several occasions found both species *living* in great abundance, in company with numerous other very varied forms. A careful scraping of the surface of the mud at the bottom of such pools is sure to yield, after resting awhile in a bottle of sea water, a rich harvest of living Rhizopoda. If the sun has been shining upon the pool for a short time, so much the better, as thin flakes of mud then rise to the surface of

the water, and may readily be skimmed off with the organisms upon them.

The test is rare among shells obtained by the usual process of drying and floating from sand. Firstly because the form is most frequent on *mud*, and secondly owing to the great tenuity of the test, which is little more than membranous, and generally collapses when dry.

Habitat.—Muddy shores round the coast generally.

Squamulina lævis, Schultze.

A minute scale-like form, round, or irregular in outline, and with simple, often central, circular orifice, occurs occasionally on the polypidoms of Zoophytes from the coast generally. I have also collected living examples. It corresponds most nearly to the above named species.

Nubecularia lucifuga, Defr.

I have referred provisionally to the genus *Nubecularia*, several obscure adherent and detached forms from the mouth of the Dee and other localities in the district, but I am in some doubt as to whether they are not merely aberrant examples of other genera.

Biloculina ringens, Lamk.

This species is generally distributed round the coast, but by no means common. It occurs also in the river Dee. The allied species *B. elongata*, d'Orb. and *B. depressa*, d'Orb. are of much more frequent occurrence.

Spiroloculina spp., d'Orb.

S. limbata, *S. planulata*, and *S. excavata*, occur sparingly over the whole area included within the limits of the Committees' observations, extending even in weaker form into the estuary of the Dee, from which locality I have also obtained a single example of the rare form *S. acutimargo*, Brady. Messrs. Balkwill and Wright also report the occurrence of this species in Dublin Bay.

Miliolina spp., Will.

Of this genus, the species *M. oblonga*, *M. seminulum*, and *M. subrotunda*, are common throughout the whole district. Very interesting chitinous brackish water examples of the latter species occur in the river Dee. *M. secans* and *M. bicornis* are rather less frequent. *M. trigonula* is generally distributed but not common. The allied form *M. tricarinata* is very rare, and has been found only at the mouth of the Dee. Of *M. venusta* and *M. boueana*, a single scarcely typical example of each has been obtained from the same locality. *M. agglutinans* is sparingly distributed over the whole district. *M. fusca* occurs in the river Dee.

Miliolina spiculifera, n.sp. (Pl. I, fig. 3).

The only remaining species of *Miliolina* does not appear to have been previously noticed. It is an elongated form allied to *M. agglutinans*, and has a "test" composed entirely of sponge spicules. The selective habit so indicated, has, in reference to other genera, been considered sufficient to warrant a separate specific name. I have, therefore, named this form *M. spiculifera*. A single example only, from the estuary of the Dee, has yet been obtained (see Pl. I, fig. 3).

Ophthalmidium inconstans, Brady.

In the paper above referred to, Messrs. Balkwill and Wright also record the occurrence, generally round the Irish coast, of a small species of *Ophthalmidium* not previously described. The genus had not been noticed before in British seas; so it is an addition to our British fauna. They figure and describe the species as *O. carinatum*, nov. sp. I have found several examples of a somewhat similar form in the Dee estuary, but they do not appear to me specifically distinct from *O. inconstans*, Brady.

Cornuspira involvens, Reuss.

This form is generally distributed, but I have not yet

found a single example of the more exclusively marine form *C. foliacea*, Philippi. This is a form which should be sought for in subsequent examination of dredged material.

Dendrophrya spp., Strethill Wright.*

"Test adherent, consisting of a sessile chamber with erect or spreading arms. Arms tubular, erect, often branching, with apertures at the distal ends. Walls chitinous, coated with mud."—Brady. *Dendrophrya* is quite common along the N. Wales coast, especially in low water pools near the Little Ormes Head. Its branching, interlacing, muddy tubes frequently cover the whole surface of the polypidoms of Polyzoa and Hydrozoa. I have found both host and Rhizopod living and active together on many occasions, and I do not doubt the genus is equally common in similar localities, *i.e.*, muddy places, round the coast generally. And yet, as Mr. Brady observes, "the genus appears to have remained entirely unnoticed by Rhizopodists." The description and figures given in the Challenger Report are from specimens obtained from the West Coast of Scotland, by Mr. D. Robertson of Glasgow, who sought specially for them at the request of Mr. Brady. Wright describes the "sarcode of the organism as differing from that of other Rhizopods, in being filled with delicate short fibres instead of the usual molecular matter, and containing both within the shell and tubes the highly refractive bodies I have mentioned in a former paper as ova."† The occurrence of the genus in some quantity in a locality which is the annual health resort of many of our local students of Natural History, offers special inducements

* Wright, *Ann. and Mag. of Natural History*, ser. 3, vol. viii, p. 122, pl. iv, figs. 4, 5. H. B. Brady, *Report on the Foram.*, vol. ix, "Challenger" Reports, p. 237, pl. xxxviia, figs. 7–9, 10–12.

† On the Reproductive Elements of the Rhizopoda, *Ann. and Mag. Nat. Hist.*, ser. 3, vol. vii, 1861, p. 360.

to follow up the suggestion here made. Further careful observation of this form could hardly fail to be productive of most valuable results. There is probably no point in Zoology bearing on which there has been less reliable information accumulated, or on which information is more desirable than the reproduction and life history of the members of the Class Rhizopoda.

Examples of both species, *D. radiata* and *D. erecta*, occur in the locality named, but they merge so insensibly into each other that it seems to me impossible to define the limits of either.

Technitella legumen, Norman.

A few specimens of this very curious little form, the test of which is entirely built up of sponge spicules, have been found in material from the estuary of the Dee.

Psammosphæra fusca, Schultze.

The specimens of this form are small and rare in our district, and hardly typical.

Hyperammina elongata, Brady.

Messrs. Balkwill and Wright (Recent Dublin Foraminifera) say of this :—"Large and very abundant at Lambay, muddy bottom ; also met with in other places in Irish Sea." The few specimens I have seen are small and weak.

Haliphysema tumanowiczii, Bowerbank.

Typical examples of this remarkable form are frequently to be found in the same prolific corner of Colwyn Bay, near to the Little Ormes Head, already quoted as the special habitat of other rare species. I have found it there on several different occasions, always fixed upon the polypidom of *Cellularia avicularia*.

Reophax spp., Montfort.

R. fusiformis and *R. scorpiurus*, are rare among those

gatherings or dredgings. *R. nodulosa*, is very rare. *R. findens*, the typical "split" or divided form, is exceedingly rare; one perfect example being all I have ever seen.

Reophax moniliforme, n.sp. (Pl. I, fig. 2).

There occur here quite frequently, fragments of an unbranched cylindrical moniliform *Reophax*, which closely resembles *R. findens*, but is not divided. Perfect specimens of this form are rare, but I have found several. Balkwill and Wright figure fragments of the form in question on pl. xiii, figs. 22, 24, of their *Recent Dublin Foraminifera*, but they do not give it a specific name. I venture, therefore, to propose for it, for convenience sake, the name *R. moniliforme* (see Pl. I, fig. 2).

Placopsilina spp., d'Orb.

The first examples obtained from this district of the forms I have referred to the genus *Placopsilina*, were adherent to a *Sertularia* dredged from the Dee estuary, off Hilbre Island, by Mr. A. O. Walker. They do not perfectly harmonise with the generic description in Mr. Brady's monograph; being somewhat more delicate and hardly as smooth on the exterior surface as the type forms. The single-chambered globular or ovoid form agrees fairly with *P. bulla;* the specific distinction of which is the monothalamous character.

Placopsilina kingsleyi, n.sp. (Pl. I, fig. 1).

On the same *Sertularia* referred to above, and frequently also from the same and other localities, I have obtained a double chambered form which seems intermediate between *P. bulla* and *P. cenomana*. This is figured on plate I, fig. 1, and as a distinguishing name for it, I venture to propose *P. kingsleyi*, in honour of the late Canon Kingsley, the founder of the Chester Society of Natural Science, and the friend and helper of all men.

Ammodiscus spp., Reuss.

A. incertus occurs rarely in shore gatherings and dredgings, and is sometimes very fine. *A. gordialis* and *A. charoides* are much more rare. *A. shoneanus* is also very rare, but it is interesting to note that since it was first recorded from the river Dee in 1878 (Siddall, *Proceedings of Chester Society Nat. Sci.*, part ii, p. 46, figs. 1, 2), it has been recorded by several observers from the coast of Ireland, and by Mr. H. B. Brady from 120 fathoms, off Christmas Harbour, Kerguelen Island, and from 3,950 fathoms—the very deepest part—in the North Pacific.

Trochammina spp., P. and S.

T. nitida and *T. inflata* are both generally distributed, but nowhere common in the district. *T. macrescens*, which is apparently but a feeble brackish-water form of *inflata*, occurs occasionally in the Dee.

Textularia spp., Defrance.

Further examination of dredgings and shore-gatherings will probably yield other species of this genus. The examples I have so far obtained do not include several that have been found on the opposite Irish coast.

Verneuilina spp., d'Orb.

The arenaceous form *V. polystropha* is generally distributed over the district; but of *V. spinulosa* only a single enfeebled example has yet been found. It is more essentially a deep-water form.

Bigenerina digitata, d'Orb.

Examples of this form are rare and small, but typical.

Bulimina spp., d'Orb.

The type form of *Bulimina*, viz., *B. pupoides*, is frequent at all depths, *B. elegans* and *B. elegantissima* are much less common. The remaining species are rarely met with. Of

B. squamigera I have only a single example, of the identity of which I am not at all assured.

Virgulina schreibersii, Cygjek.

Very rare, but specimens typical.

Bolivina spp., d'Orb.

B. ænariensis, Costa, was erroneously described in the Foraminifera of the River Dee, as *B. costata*, d'Orb.

Cassidulina spp., d'Orb.

C. lævigata and *C. crassa* are both of rare occurrence and feeble development in the district.

Lagena spp., Walker and Jacob.

The beautiful genus *Lagena* is represented by a great variety of forms, every one of which has been found to extend even into the brackish water of the River Dee. *L. sulcata* and *L. lævis* are universal and are common everywhere round the coast. The species *L. semistriata*, *L. striata*, *L. marginata*, *L. squamosa*, *L. lucida*, and *L. apiculata* are also general, but much less common. The remaining species have not yet been observed in our district beyond the estuary of the Dee. Previous to its occurrence in the Dee *L. aspera* had only been known as a Tertiary fossil form. *L. gracilis*, *L. orbignyana*, *L. ornata*, *L. pulchella*, and *L. hispida* are also exceedingly rare. The twenty-nine species named in this list do not include all those known as British, and it is very probable that further observations will considerably extend the list.

Nodosaria spp., Lamk.

Of this genus all the six species observed are of general distribution, excepting only *N. hispida*, of which I have seen only one specimen, and that a broken one, from the river Dee, near Hilbre Island. Uncertainty as to its name caused me to omit it from the List of Dee Foraminifera, but Messrs.

Balkwill and Wright describe and figure it in their admirable list of Dublin Foraminifera. Their two specimens were obtained respectively from off the Hen and Chickens, Isle of Man, and between the Isle of Man and the Mourne mountains.

Marginulina spp., d'Orb.

Both *M. costata* and *M. glabra* are very rare. Of the latter I have several very fair examples, but only one of the former, and that has its terminal chamber broken.

Vaginulina legumen, d'Orb.

V. legumen is the only species of the genus I have seen, and of this only a single example.

Cristellaria spp., Lamk.

C. crepidula is by far the most common of the three species obtained in the district. A very fine example of this species (now in the cabinet of my friend, Mr. W. Shone, F.G.S.), was found by his mother, who was a most indefatigable student of Foraminifera, in material obtained at Hilbre Island. Several of the later chambers of the specimen contain young *Cristellaria*. Most of these consist only of the small globular shell which forms the primary chamber in the genus, but several others have also added a second chamber upon the first. The size of these young forms is such that they could only be liberated upon the breaking up of the parent shell. Mr. Brady has figured this peculiar specimen on pl. lxvii of his "Challenger" Foraminifera, in which work may also be found numerous other examples of a similar viviparous method of reproduction.

Polymorphina spp., d'Orb.

P. lactea, *P. gibba*, and *P. communis* are generally present in all gatherings. *P. thouini* is a very rare form. *P. spinosa* is exceedingly rare; previous to its discovery in

the Dee, it had only been known as a miocene fossil form. *P. lanceolata* was described as *P. fusiformis* in the Dee catalogue. *P. concava* is a small rare form, concave on one surface and with a wing, or flattened out extension of shell substance surrounding it. It is said to be parasitic; but all our specimens are free. *P. orbignyi* is a name given to several species with numerous irregularly projecting apertures. Mr. Brady does not figure any of the three last-named forms.

Uvigerina spp., d'Orb.

U. pygmæa and *U. angulosa* are of frequent occurrence, and generally distributed. *U. canariensis* (*U. irregularis*, Brady, Dee catalogue) is very rare.

Orbulina, d'Orb.

I have several examples of what I take to be this form from the River Dee, which are brown and chitinous, but not perfectly calcareous. This imperfectly calcified condition is frequent among the porcellanous group Miliolidæ, but very unusual in the Perforata.

Globigerina bulloides, d'Orb.

General, but never common.

Pullenia sphæroides, d'Orb.

Is very diminutive, and very rare. Only Dee specimens observed.

Sphæroidina dehiscens, P. and J.

Essentially a deep water form; very small and feeble with us. Only one example from Dee estuary found.

Spirillina spp., Ehrenb.

All the four species of this genus are rare. Of *S. margaritifera*, I have only one specimen, which I obtained in a tow-net from the "bore" of the tide at Chester. *S. tuberculata* is also very rare, and was first described (though not

first discovered) in the Dee catalogue, from Mr. Brady's MS. notes. *S. limbata* is very rare.

Patellina corrugata, Will.

A very pretty, distinct, and well-marked form, which is frequent, though very small in our district.

Discorbina spp., P. and J.

D. globularis is common everywhere in the district. *D. ochracea* was figured and described by Prof. Williamson, in his *Recent Foraminifera of Great Britain*; but is not figured or described by Mr. Brady. *D. biconcava* is a well-marked form, which when found in the Dee, was new to the British Fauna. *D. tuberculata* is figured and described by Messrs. Balkwill and Wright in the Dublin catalogue. It is a rare but distinct form, studded with large tubercles, each of which is perforated in the only specimen I have found.

Planorbulina mediterranensis, d'Orb.

Is very distinct and well developed, and frequent over the whole district. I have also found two of the very singular rolled-up forms of the shell.

Truncatulina spp., d'Orb.

T. lobatula is one of the common shells of the district; the other three species are rare, and barely typical.

Pulvinulina spp., P. and J.

This is essentially a deep water genus, and the forms we get in the district are always feeble and ill-developed.

Rotalia spp., Lamk.

R. beccarii is as common as possible, and occurs in abundance in every locality. *R. nitida* is probably only its young state.

Gypsina inhærens, Schultze.

Described as *Tinoporus lucidus* in the Dee list. It is very rare in the district.

Nonionina spp., d'Orb.

N. depressula is very common. All the others are rare, and none of them well-developed.

Polystomella spp., Lamk.

P. striata-punctata is present in abundance everywhere,—*P. crispa* is comparatively rare.

The following Table gives a complete list of the species and varieties which have been observed in the district, with their localities and indications of their relative frequency of occurrence.

Explanation of Plate I.

Fig. 1.—*Placopsilina kingsleyi*, n.sp., attached to a *Sertularia*, × 40 diameters.

Fig. 2.—*Reophax moniliforme*, n.sp., × 50 diameters.

Fig. 3.—*Miliolina spiculifera*, n.sp., × 100 diameters.

SUB-KINGDOM—PROTOZOA.

Class—Rhizopoda.

ORDER—FORAMINIFERA (RETICULARIA).

Family I.—Gromidæ.

Test membranous and flexible, or chitinous and rigid; imperforate.

	Plate. (*In Mr. Brady's Monograph.*)	Fig.	Remarks.
Lieberkühnia. Claparède			
wageneri. Clap.			Colwyn Bay, rare.
Shepheardella. Siddall			
tæniformis. Sid.			Colwyn Bay, very rare.
Gromia. Dujardin			
dujardinii. Schultze			River Dee, rare.
oviformis. Duj.			River Dee, frequent.

Family II.—Miliolidæ.

"Test imperforate, normally calcareous and porcellanous, sometimes encrusted with sand, under starved conditions (*e.g.*, in brackish water) becoming chitinous or chitino-arenaceous."

Sub-Family 1.—Nubecularinæ.

Squamulina. Schul.			
lævis. Schul.			Colwyn Bay, on Zoophytes, very rare.
Nubecularia. Defrance			
lucifuga. Defr.	1	9-16	Colwyn Bay, on Zoophytes, specimens very obscure and doubtful.

Sub-Family 2.—Miliolidæ.

	Plate.	Fig.	Remarks.
Biloculina. D'Orb.			
ringens. Lamk.	II	7-8	Colwyn Bay, and general, but not common.
depressa. D'Orb.	II	15-17	Generally distributed round Coast.
elongata. D'Orb.	II	9	Generally distributed round Coast.
Spiroloculina. D'Orb.			
limbata. D'Orb.	IX-X	15-7, 1-2	Not at all common anywhere round the North Wales Coast.
planulata. D'Orb.	IX	11	
excavata. D'Orb.	IX	5-6	
acutimargo. Brady	X	12-15	Estuary of Dee, very rare.
Miliolina. Will.			
trigonula. Lamk.	III	14-16	Dee, Colwyn, and Llandudno, rare.
tricarinata. D'Orb.	III	17	Dee, Colwyn, and Llandudno, very rare.
oblonga. Montagu...	V	4	Frequent everywhere.
boueana. D'Orb.	VII	13	Estuary of Dee, very rare, a doubtful example.
seminulum. Linn	V	6	General.
venusta. Karrer	V	5-7	Same remarks apply as to *M. boueana.*
subrotunda. Mont.	V	10-11	Very common, some of river Dee specimens chitinous only.
secans. D'Orb.	VI	1-2	A moderately common form.
bicornis. W. & J.	VI	9, 11, 12	A moderately common form.
ferussacii. D'Orb.	CXIII	17	One specimen from Dee Estuary only.
fusca. Brady			Rare in Dee.
agglutinans. D'Orb.	VIII	6, 7	Rare in Dee and Colwyn.
spiculifera, n. sp.			Estuary of Dee, a good example only.

Sub-Family 3.—Haueininæ.

	Plate.	Fig.	Remarks.
Ophthalmidium. Kubler *inconstans.* Brady...	XII	5, 7, 8	Rare, Estuary of Dee.

Sub-Family 4.—Peneroplidinæ.

Cornuspira. Schul. *involvens.* Reuss.	XI	1-3	Not common, but generally distributed.

Family III.—Astrorhizidæ.

"Test invariably composite, usually of large size and monothalamous"—built up of sand grains, sponge spicules, or particles of mud, &c.

Sub-Family 1.—Astrorhizinæ.

Dendrophrya, Strethill Wright *radiata.* S. Wright	XXVIIA	10-12	Colwyn Bay, frequent on Zoophytes.
erecta. S. Wright	XXVIIA	7-9	

Sub-Family 2.—Pilulininæ.

Technitella. Norman *legumen.* Norman	XXV	8-12	Estuary of Dee, very rare.

Sub-Family 3.—Saccamininæ.

Psammosphæra. Schul. *fusca.* Schul.	XVIII	1-8	Specimens doubtful.

Sub-Family 4.—Rhabdamminæ.

Hyperammina. Brady *elongata.* Brady	XXIII	4, 7-10	Very rare.
Haliphysema. Bowerbank *tumanowiczii.* Bow.	XVIIA	4-5	Colwyn Bay.

Family IV.—Lituolidæ.

"Test arenaceous, usually regular in contour. Comprises sandy isomorphs of many porcellanous and hyaline forms, together with some adherent species."

Sub-Family 1.—Lituolinæ.

	Plate.	Fig.	Remarks.
Reophax. Montfort			
fusiformis. Will.	XXX	7-11	Rare.
scorpiurus. Montf.	XXX	12-17	Rare.
findens. G. M. Dawson ...	XXXII	10, 11	Typical form, very rare.
moniliforme, n. sp.			
nodulosa. Brady	XXXI	1-9	Very rare.
Haplophragmium. Reuss			
globigeriniforme. P. & J. ...	XXXV	10, 11	Very rare.
canariensis. D'Orb.	XXXV	1-5	Frequent.
Placopsilina. D'Orb.			
bulla. Brady	XXXV	16, 17	Very rare, examples not typical.
kingsleyi, n. sp.			Rare.

Sub-Family 2.—Trochammininæ.

Ammodiscus. Reuss			
incertus. D'Orb.	XXXVIII	1-3	Estuary of Dee, rare.
gordialis. J. & J.	XXXVIII	7-9	Estuary of Dee, very rare.
charoides. P. & J....	XXXVIII	10-16	Estuary of Dee, very rare.
shoneanus Sid.	XXXVIII	17-19	Estuary of Dee, very rare.
Trochammina. P. & J.			
nitida. Brady	XLI	5, 6	Rather rare.
inflata. Mont.	XLI	4	Rather rare.
macrescens. Brady			Rather rare.

Family V.—Textularidæ.

"Tests of larger species arenaceous, with or without a perforate calcareous basis; smaller forms hyaline and conspicuously perforate. Chambers arranged in two or more alternating series, more rarely spiral or confused, often dimorphous."

Sub-Family 1.—Textularinæ.

	Plate.	Fig.	Remarks.
Textularia. Defr.			
sagittula. Defr.	XLII	17, 18	Rare.
agglutinans. D'Orb.	XLIII	1-3	Rare.
var. *porrecta.* Brady	XLIII	4	Very rare.
variabilis. Will.			Frequent.
Verneuilina. D'Orb.			
polystropha. Reuss	XLVII	15-17	Rare.
spinulosa. Reuss	XLVII	1-3	Very rare.
Bigenerina. D'Orb.			
digitata. D'Orb.	XLIV	19-24	Very rare.

Sub-Family 2.—Buliminin æ.

Bulimina. D'Orb.			
pupoides. D'Orb.	L	15	Frequent.
elongata. D'Orb.	LI	1	Rare.
marginata. D'Orb.	LI	3-5	Rare.
aculeata. D'Orb.	LI	7-9	Very rare.
ovata. D'Orb.	L	13	Rare.
elegans. D'Orb.	L	1-4	Not common.
elegantissima. D'Orb.	L	20-22	Not common.
squamigera. D'Orb.			Very rare.

Sub-family 2.—Buliminin*æ*—*continued*.

	Plate.	Fig.	Remarks.
Virgulina. D'Orb.			
schreibersiana. Czjzek	LII	1-3	Very rare.
Bolivina. D'Orb.			
punctata. D'Orb.	LII	18-19	Frequent.
plicata. D'Orb.			Not common.
pygmæa. D'Orb.	LIII	5, 6	Not common.
difformis. D'Orb.			Rare.
ænariensis. Costa	LIII	10-11	Rare.

Sub-Family 3.—Cassidulinin*æ*.

Cassidulina. D'Orb.			
lævigata. D'Orb.	LIV	1-3	Rare.
crassa. D'Orb.	LIV	4, 5	Rare.

Family VII.—Lagenid*æ*.

"Test calcareous, finely perforated, either monothalamous, or consisting of a number of chambers joined in a straight, curved, spiral, alternating, or (rarely) branching series. Aperture simple or radiate, terminal."

Sub-Family 1.—Lageninæ.

Lagena. Walker & Jacob			
sulcata. W. & J.	LVII	23, 33	Very common.
var. *interrupta*. Will.	LVII	25, 27	Very common.
var. *costata*. Will.			Very common.
var. *williamsoni*. Alcock ...			Very common.
var. *caudata*. P. & J.			Not common.

	Plate.	Fig.	Remarks.
Lagena. Walker & Jacob			
lyelli. Seguenza			Very rare.
feildeniana. Brady	LVIII	38, 39	Very rare.
striato-punctata. P. & J. ...			Very rare.
lævis. Mont.	LVI	7-12	Very common.
gracillima. Seg.	LVI	19, 28	Very rare.
apiculata. Reuss	LVI	15-18	Frequent.
globosa. Mont.	LVI	1-3	Frequent.
striata. D'Orb.	LVII	22, 24	Common.
gracilis. Will.	LVIII	2, 3, 7	Very rare.
semistriata. Will.	LVII	14, 16, 17	Common.
distoma. P. & J.	LVIII	11-15	Very rare.
aspera. Reuss	LVII	6-12	Very rare.
marginata. W. & J.	LIX	21-23	Common.
orbignyana. Seg.	LIX	24-26	Very rare.
trigona-marginata. P. & J. ...	LXI	12, 13	Very rare.
lucida. Will			Frequent.
trigono-oblonga. Seg. & Sid. ...	LXI	11	Rare.
ornata. Will.			Very rare.
trigono-ornata. Brady ...	LXI	14	Very rare.
pulchella. Brady			Very rare.
melo. D'Orb.			Common.
squamosa. Mont.	LVIII	28-31	Common.
hexagona. Will.	LVIII	32, 33	Common.
hispida. Reuss	LVII	1-4	Very rare.

Sub-Family 2.—Nodosarinæ.

	Plate.	Fig.	Remarks.
Nodosaria. Lamk.			
scalaris. Batsch	LXIII	28-31	Frequent.
radicula. Linn.	LXI	28-31	Very rare.
hispida. D'Orb.	LXIII	12-16	Very rare.
pyrula. D'Orb.	LXII	10-12	Frequent.
(*Dentalina*)			
communis. D'Orb.	LXII	19-22	Frequent.
obliqua. D'Orb.	LXIV	20-22	Rare.
Marginulina. D'Orb.			
costata. Batsch	LXV	10-13	Very rare.
glabra. D'Orb.	LXV	5, 6	Very rare.
Vaginulina. D'Orb.			
legumen. Linn.	LXVI	13-15	Very rare.
Cristellaria. Lamk.			
rotulata. Lamk.	LXIX	13	Rare.
crepidula. F. & M.	LXVII	17, 19	Frequent.
italica. Defr.	LXVIII	20-23	Rare.

Sub-Family 3.—Polymorphininæ.

Polymorphina. D'Orb.			
lactea. W. & J.	LXXI	11, 14	Frequent.
var. *oblonga.* Will.			Frequent.
gibba. D'Orb.	LXXI	12	Frequent.
subæqualis. D'Orb.			Frequent.
communis. D'Orb.	LXXII	19	Frequent.
thouini. D'Orb.	LXXII	18	Very rare.

Sub-Family 3.—Polymorphininæ—*continued*.

	Plate.	Fig.	Remarks.
Polymorphina. D'Orb.			
compressa. D'Orb.	LXXII	9-11	Frequent.
lanceolata. Reuss	LXXII	5, 6	Rare.
concava. Will.			Rare.
spinosa. D'Orb.			Very rare.
orbignyii. Zborzewskii			Rare.
Uvigerina. D'Orb.			
pygmea. D'Orb.	LXXIV	11-14	Frequent.
angulosa. Will.	LXXIV	15-18	Frequent.
canariensis. D'Orb.	LXXIV	1-3	Rare.

Family VIII.—Globigerinidæ.

"Test free, calcareous, perforate; chambers few, inflated, arranged spirally; aperture single or multiple, conspicuous."

Sub-Family 1.—Globigerinæ.

Orbulina. D'Orb.			
universa. D'Orb.	LXXVIII	8-26	Rare.
Globigerina. D'Orb.			
bulloides. D'Orb.	LXXVII	3-7	Frequent.
Pullenia. P. & J.			
sphæroides. D'Orb.	LXXXIV	12, 13	Very rare.
Sphæroidina. D'Orb.			
dehiscens. P. & J.	LXXXIV	8-11	Very rare.

Family IX.—Rotalidæ.

"Test free or adherent, calcareous, perforate; typically spiral and 'Rotaliform,' *i.e.*, whole of the chambers visible on the superior surface, those of the last convolution only on the inferior (apertural) surface."

Sub-Family 1.—Spirillininæ.

	Plate.	Fig.	Remarks.
Spirillina. Ehrenb.			
vivipara. Ehrenb	LXXXV	1-5	Rare.
margaritifera. Will.			Very rare.
tuberculata. Brady	LXXXV	12-16	Very rare.
limbata. Brady	LXXXV	18-21	Very rare.

Sub-Family 2.—Rotalinæ.

Patellina. Will.			
corrugata. Will.	LXXXVI	1-7	Frequent.
Discorbina. P. & J.			
rosacea. D'Orb.	LXXXVII	1-4	Frequent.
ochracea. Will.			Rare.
globularis. D'Orb.	LXXXVI	8-13	Common.
orbicularis. Terquem	LXXXVIII	4-8	Rare.
biconcava. P. & J.	XCI	2, 3	Very rare.
turbo. D'orb.	LXXXVII	8	Rare.
tuberculata. Balkwill & Wright ...			Very rare, one specimen from Dee only.
Planorbulina. D'Orb.			
mediterranensis. D'Orb.	XCII	1-3	Common.
Truncatulina. D'Orb.			
haidengerii. D'Orb.	XCV	7	Rather rare.
ungeriana. D'Orb.	XCIV	9	Rather rare.

Sub-Family 2.—ROTALINÆ—*continued*.

	Plate.	Fig.	Remarks.
Truncatulina. D'Orb.			
lobatula. Walker	XCII	10	Very common.
refulgens. Montf.	XCII	7-9	Rare.
Pulvinulina. P. & J.			
repanda. F. & M....	CIV	18	Not common.
auricula. F. & M.	CVI	5	Rare.
canariensis. D'Orb.	CIII	8-10	Very rare.
Rotalia. Lamk.			
beccarii. Linn.	CVII	2, 3	Very common.
nitida. Will.			Common.

Sub-Family 3.—TINOPORINÆ.

Gypsina. Carter			
inhærens. Schul.	CII	1-6	Very uncommon.

Family X.—NUMMULINIDÆ.

"Test typically free, polythalamous, symmetrically spiral; calcareous and finely tubulated"

Sub-Family 2.—POLYSTOMELLINÆ.

Nonionina. D'Orb.			
asterizans. F. & M.	CIX	1, 2	Rare.
turgida. Will.	CIX	17-19	Rare.
scapha. F. & M.	CIX	14-16	Rare.
umbilicatula. Mont.	CIX	8, 9	Rare.
depressula. W. & J.	CIX	6, 7	Very common.
stelligera. D'Orb.	CIX	3-5	Rare.
Polystomella. Lamk.			
crispa. Linn	CX	6, 7	Common.
striato-punctata. F. & M... ...	CIX	22, 23	Very common.

REPORT on the PORIFERA of the L. M. B. C. DISTRICT.

By Thos. Higgin, F. L. S.

The following classification will show the systematic position of the species discussed in this Report, while the right hand column will serve as a list of all the species collected.

PORIFERA (= Class **SPONGIDA,** Huxley).

Order I.—CARNOSA (Carter).

Family.	Group.	Genus.	Species.
Halisarcida....	..	...	*Halisarca dujardinii*, J.

Order III.—PSAMMONEMATA (Carter).

Family.	Group.	Genus.	Species.
Arenida.	... *Arenosa.*	...	*Dysidea fragilis*, J.

Order IV.—RHAPHIDONEMATA (Carter).

Family.	Group.	Genus.	Species.
Chalinida.	...*Digitata.*	...	*Chalina oculata*, Bk.
	Reptata.	...	*Chalina limbata*, Bk.

Order V.—ECHINONEMATA (Carter).

Family.	Group.	Genus.	Species.
Ectyonida.	*Dictyocylindrina.*	*Dictyocylindrus stuposus*, Bk.	
	Plumohalichondrina.	*Plumohalichondria plumosa*, C.	
	Echinoclathrina.	...*Ophlitaspongia seriata*, Bk.	

Order VI.—HOLORHAPHIDOTA (Carter).

Family.	Group.	Genus.	Species.
Renierida.	...*Amorphosa.* ...		*Amorphina panicea*, S.
			Amorphina coccinea, S.
			Amorphina albescens, S.
			Amorphina caruncula, S.

Family.	Group.	Genus. Species.
RENIERIDA.	*Isodictyosa.* ...	*Isodictya varians*, Bk.
		Isodictya elegans, Bk.
		Isodictya simulans, Bk.
		Isodictya pallida, Bk.
		Isodictya densa, Bk.
		Isodictya fistulosa, Bk.
		Isodictya clava, Bk.
		Isodictya fucorum, Bk.
	Halichondrina.	*Halichondria incrustans*, J.
	Esperina. ...	*Esperia ægagropila*, C.
SUBERITIDA.	*Suberitina.* ...	*Cliona celata*, J.
		Raphyrus griffithsia, Bk.
		Suberites carnosa, S.
		Suberites suberea, S.
		Hymeniacidon sanguinea, Bk.
PACHYTRAGIDA.	*Geodina.*	*Pachymatisma johnstonia*, Bk.
	Stellettina. ...	*Ecionema ponderosa*, Bk.
		Stelletta grubii, Sdt.
PACHASTRELLIDA.	*Pachastrellina.*	*Dercitus niger*, C.

Order. VIII.—CALCAREA (Haeckel).

Family.	Group.	Genus. Species.
ASCONES.		*Ascetta coriacea*
		Ascaltis botryoides
LEUCONES.		*Leucandra fistulosa*
		Leucandra gossei
		Leucandra nivea
		Leucandra johnstonii
SYCONES.		*Sycandra ciliata*
		Sycandra compressa
		Aphroceras ramosa, n.sp.

The arrangement of all Sponges, excepting the Calcarea, followed in these notes is that published by Mr. Carter, in

his "Notes introductory to the study and classification of the SPONGIDA,"* and corresponds with the "teaching collection," arranged by me in the Free Museum, Liverpool, in trays containing examples of all the groups.

The specimens obtained by Professor W. A. Herdman will be alluded to with the letters L. M. B. C., with locality and a number, being part of the collection of the Liverpool Marine Biology Committee, and those found by Mr. T. J. Moore and Mr. Higgin, under the letters L. F. M., being part of the collection of the Liverpool Free Museum.

The specimens in the L. F. M. collection of species, named by Dr. Bowerbank, to which the letter V is attached, were verified by him a few years before his death. This is of considerable importance, because the student finds it very difficult, and in many cases impossible, to recognise Bowerbank's species from his descriptions of them; whilst, in many instances, his illustrations afford no assistance.

Order I.—CARNOSA.

Family—HALISARCIDA.

Halisarca dujardinii, Johnston.

This interesting species, having no spicules or skeletal parts, was first observed by Dujardin on the coast of Normandy in 1838, and by him it was named *Halisarca*. In 1842 Dr. Johnston found it, and described it in "British Sponges" as *Halisarca dujardinii*. In 1862 Dr. Oscar Schmidt described a new species differing in form and colour from *H. dujardinii*, as *Halisarca lobularis*. In 1847 Nardo described another aspiculous sponge under the generic name of *Chondrosia*, and stated that it had for many years been known to the fishermen of the Mediterranean as *Carume di*

* *Annals and Mag. Nat. Hist.*, 1875; ser. 4, vol. xvi.

Mar, and since that time several other species have been described. The different varieties of Carnosa now known, including both aspiculous and spiculous species, have lately been grouped by Mr. H. J. Carter, F.R.S., in two families—Halisarcida and Gumminida (*Annals and Mag. Nat. Hist.*, October, 1881), embracing in all twenty-five species.*

The specimens of *H. dujardinii* found at Holyhead in March, 1873, contained ova in the first stage of development only, that is before any duplicate subdivision had taken place, but those obtained by Mr. Carter in July and August the following year contained ova as well as embryos in every stage of development. The Port Erin examples also, gathered in July and August last year, contained embryos in the later stages of development.

Dr. Bowerbank would not believe in the existence of sponges without any spicules, and assumed that Dr. Johnston was mistaken in not finding spicules in the sponge he described. He has figured a thin coating sponge amongst his Hymeniacidons as *Hymeniacidon dujardinii*, under the impression that this must have been the species Dr. Johnston had described (*Mon. Brit. Spon.*, vol. iii, pl. 38, fig. 1 to 4).†

L. M. B. C., No. 85. 1., near low-water mark, Bay-ny-Carrickey, between Port St. Mary and Poyllvaaish, Isle of Man, Aug. 8., 1885 ; from *Laminaria* roots on shore between Port St. Mary and Spanish Head, Isle of Man, Aug. 13, 1885; in rock-pools, near Port Erin, Isle of Man, Aug., 1885.

L. F. M., No. 22. 4. 74, 3. Collected at Holyhead.

* See also Carter's papers in 1874 in *Annals and Mag. Nat. Hist.*, "On the Spongozoa of *Halisarca dujardinii*," and "On the *Halisarca lobularis*," also "Development of Marine Sponges," &c., &c., 1874.

† For excellent work on *Halisarca*, with beautiful and faithful plates, see the papers by F. E. Schultze in *Zeitschrift f. wiss. Zoologie*, 1877, Bd. xxviii, and 1879, Bd. xxix.

Order III.—PSAMMONEMATA.

Family.—Arenida.

Dysidea fragilis, Johnston.

This sponge, which is found all round our coasts, and is widely distributed over other parts of the world, was called *fragilis* by Dr. Johnston* because when dried it is easily made to crumble away. This arises from the nature of its skeletal parts. The skeleton is composed of grains of sand taken up by the sponge from the wash of the tide, and worked into a network by being agglutinated together by a very small quantity of horny material. Consequently when the sponge is dried, the horny matter being in such small proportion, the grains of sand easily become separated and the skeleton breaks up. It is the *Spongelia* of Dr. O. Schmidt.† Only two British representatives of arenaceous sponges have been described. Mr. Carter has placed them in his order Psammonemata, which also contains the "Sponge of Commerce" or "bath sponge," whose skeleton is clear horny material, almost entirely, if not altogether, free from grains of sand. Mr. Carter, however, states that there are always some grains of sand to be found in some parts of the fibre of even the best specimens of "Turkey Sponge." The order, therefore, contains every variety of arenaceous fibre, from *Spongia officinalis* to such sponges as *Dysidea fragilis*.

L. F. M., No. 24. 5. 73. 14. Collected at Holyhead.

Order IV.—RHAPHIDONEMATA.

Family.—Chalinida.

Chalina oculata, Bk.

Halichondria oculata, J.

Chalina polychotoma, Carter.

Spongia polychotoma, Esper.

* *British Sponges*, p. 187; see also Bowerbank, *Mon. Brit. Spong.*, vol. i, pl. xiv., fig. 270; vol. ii, p. 381, and vol. iii, pl. lxix.

† *Spongienfauna Atlan.*, 1870, p. 77.

This digitate species is representative of Mr. Carter's family Chalinida, and of his order Rhaphidonemata, which embraces all sponges having a horny fibre cored with spicules produced by the sponge.*

L. F. M., No. 29. 12. 61. 1. Collected at Morecambe Bay.

Chalina limbata, Bk.

Spongia Limbata, Johnston.

This is a *Chalina* of quite different form and appearance from *C. oculata*, but it is distinctly a *Chalina*, a pretty network of horny matter enclosing the acerate spicules of the species. It is a sessile species.†

L. M. B. C., No. 85.2. Collected at Port Erin, Isle of Man.

L. F. M., No. 24. 9. 73. 1. Collected at Holyhead.

Order V.—ECHINONEMATA.

Family.—Ectyonida.

Dictyocylindrus stuposus, Bk.

This is a *Dictyocylindrus* with a stellate flesh spicule, and is most probably the *Raspalia stelligera* of Schmidt. Mr. Carter has lately broken up his group Pluriformia into three divisions, the last of which is Dictyocylindrina, to receive sponges of this type. The appearance of the stellate spicule in this species‡ is a noticeable feature, probably evidencing a relationship to some species in the next order, Holorhaphidota.

L. M. B. C., No. 85. 3. Collected at Port Erin, Isle of Man.

L. F. M., No. 29. 10. 73. 1. Collected at Holyhead.

* See fig. 262, pl. xiii, vol. i, Bowerbank's *Mon. Brit. Spong.*; Johnston's *Brit. Spong.*, fig. 94, pl. iii; *Mon. Brit. Spong.*, vol. iii, pl. lxvi; Esper., 1794, taf. xxxvi; *Annals and Mag. Nat. Hist.*, October, 1885.

† See *Mon. Brit. Sponges*, vol. ii, p. 373; vol. iii, pl. lxvii.

‡ *Mon. Brit. Spon.*, vol. iii, pl. xix, figs. 1–7; *Spongienf. Atlan.*, p. 60, taf. 5, fig. 14.

Plumohalichondria plumosa, C.

Hymeniacidon plumosa, Bk. = *Microciona plumosa*, Bk.
Halichondria plumosa, J.

This species, as well as *Ophlitaspongia seriata*, represents, with a few other species, the British examples of Mr. Carter's order Echinonemata, which embraces all sponges whose fibre is echinated with spicules.*

L. F. M., No. 32. 3. 73. 2. Collected at Holyhead.

Ophlitaspongia seriata, Bk.

Chalina seriata, Bk. = *Halichondria seriata*, J.

This species† is plentiful at Holyhead, surrounding in a layer about a quarter of an inch thick, the stems of *Laminaria*.

L. F. M., No. 25. 9. 73. 12. Collected at Holyhead.

Order VI.—HOLORHAPHIDOTA.

Family.—Renierida.

Group.—Amorphosa.

Amorphina panicea, S.

Halichondria panicea, J.

This is a species‡ without any fibrous skeletal structure, the spicules, which are simple acerate, being dispersed throughout the sponge substance, and loosely congregated together in support of the areolar mass, which, when cut through, has the appearance of a slice of bread (bread-

* For illustrations of this kind of fibre see figs. 287, 288, 289, 290 and 291, pl. xvii, *Mon. Brit. Spong.*, vol. i. For illustration of the fibre of this species, see fig. 13, pl. xxiv, vol. iii.

† For illustration of the fibre of this species, see fig. 287, pl. xvii, vol. i, *Mon. Brit. Spong.* For figure of sponge coating a piece of rock, see pl. lxv, vol. iii.

‡ For good illustrations of the usual forms of this sponge, see pl. xl, vol. iii, *Mon. Brit. Spong.* Johnston's *Brit. Spong.*, p. 114, pl. xxxi; *Mon. Brit. Spong.*, vol. i, pl. xix, fig. 300; vol. ii, p. 229; vol. iii, pl. xxxix and xl.

crumb). Sponges of this character come under Schmidt's genus *Amorphina*, and into Mr. Carter's group Amorphosa. Amorphosa is the first group in Mr. Carter's Order VI, which embraces the *Reniera* of Schmidt, the *Suberites* and the Pachytragida, or Corticata, as well as the Lithistina and *Spongilla*. It is a very large order, but the divisions of it are very marked, and easily distinguishable.

L. M. B. C., No. 85. 4. Collected at Hilbre Island, and also at Port Erin, Isle of Man.

L. F. M., No. 24. 5. 73, 4. From the Egremont shore and Holyhead.

Amorphina coccinea, S.

Hymeniacidon coccinea, Bk.

This species is, as its name implies, a scarlet coloured sponge, and having acerate spicules, I have placed it in the group Amorphosa. It is a sessile species. The specimen in the L. F. M. Collection is mentioned by Dr. Bowerbank in his third volume, page 353.

L. F. M., No. 24. 5. 73, 16. Collected in Belfast Lough. V.

Amorphina albescens, S.

Hymeniacidon albescens, Bk.

This is a sessile species, which puts out usually one, but sometimes more than one, branch, about a couple of inches in length, with a diameter of a quarter of an inch or less. It is yellow when living, but in the dried state is greyish white. Its spicules, like those of the preceding species, are acerate.

L. F. M., No. 22. 4. 9. 74, 5. Holyhead. V.

Amorphina caruncula, S.

Hymeniacidon caruncula, Bk.

Dr. Bowerbank makes this species to differ from its very near relative *Hymeniacidon sanguinea* in colour, and in the size of its spicules. In the living state it is "light to deep

orange," whilst the other is "blood red;" and its spicules are rather stout acuates, whilst those of *H. sanguinea* are of the same form but longer.

L. M. B. C., No. 85. 5. Collected in shore pools at Kitterland, near Port Erin, Isle of Man.

L. F. M., No. 32. 3. 73, 1. Collected at Holyhead. V.

Group Isodictyosa.

Isodictya varians, Bk.

This sponge, belonging to the group Isodictyosa, rather resembles *Chalina oculata* in appearance—compare plates lxvi and lxxxviii in Dr. Bowerbank's third volume—but it differs greatly under the microscope. The skeleton of *C. oculata* is a horny fibre cored with spicules, whilst that of *I. varians* is a structure made up of spicules merely held together, where they touch each other, with horny matter; the spicules are simply cemented together thus, and are not enclosed in horny fibre. This difference distinguishes the Chalinas from the Isodictyas, and these species, which resemble each other so much in form, are good examples of the two groups. The orders Rhaphidonemata and Holorhaphidota run together in *Isodictya*, and perhaps the group of Isodictyosa might without disadvantage be taken out of the latter order and placed in the same order with Chalinida. Dr. Bowerbank's plate lxxxviii in his third volume is from a specimen in the Liverpool Free Museum, one of a large number taken at low water near the old ferry slip at Egremont by myself, in company with Mr. T. J. Moore, in 1869. It was found flourishing in the bed of a stream of warm *fresh* water running from the engine-house connected with the slip. The fact that this marine species was found in brackish water growing luxuriantly within the influence of a fresh water stream, becomes of great interest when considered in relation to a fresh-

water sponge found in very deep pools in a South American river, more than two hundred miles from the sea (river Uruguay),* together with some others of like form from deep parts of an inland lake (Lake Baikal).† Dr. Bowerbank described this Uruguay species in his "Monograph of the Spongillidæ" (*Proc. Zool. Soc.*, Nov., 24, 1863), under the name *Spongilla coralloides*, but Mr. Carter (*Annals and Mag. Nat. Hist.*, Feby. 1881), created a new genus for it, *Uruguaya*, and grouped it with the other sponges of similar growth just alluded to, *Lubomirskia baicalensis*, and its varieties.

Isodictya varians, until the discovery of the sponge in the Mersey, was only known by "a small fragment surrounding two adjoining branches of a small *Fucus*, forming two parallel and united cylinders of sponge, an inch in length, and seven lines in width, and varying in thickness from one to two lines, sent to Dr. Johnston by Mr. Barlee, from Shetland." Whether this fragment was brought up by the dredge or was picked up on the shore does not appear. It is, however, clear that it is not common on our coasts as a marine species, whilst the great profusion in which it was found at Egremont under the circumstances already stated (for the bed of the stream was thickly covered with it), indicates that the conditions of life there were most favourable for its growth and development. It thus appears to form a link between marine and fresh water sponges. Marine sponges reproduce by means of ova and spermatozoa, and fresh water sponges can also reproduce in this way, as was shown by Lieberkühn in 1856 (*Beiträge zur Entwickelungsgechichte der Spongillen, Archiv f. Anat. u. Physiologie*, Heft i, u. ii, pp. 1–19, January), but all fresh water sponges, with

* *Proc. Lit. and Phil. Soc. Liverpool*, 1877–8, vol. 32, p. lvi—"On a fresh-water Sponge from Bahia," T. Higgin, F.L.S.

† *Annals and Mag. Nat. Hist.*, Feby., 1881, and July, 1884.

the exception of the one from the river Uruguay and those from Lake Baikal, have been proved to reproduce in addition by means of a seed-like body or "statoblast." The method of reproduction in the case of *Uruguaya coralloides*, and of *Lubomirskia baicalensis* with its varieties and allies, is not known, but the most diligent search by various observers has not resulted in finding the statoblast in any examples of the different species. In this respect, for the present, these fresh water species stand apart from the rest of the Spongillidæ which are classified according to the spicules of the statoblast, the body spicules of the various species not being sufficiently different from each other for the purpose. *Isodictya varians** in its form bears a very strong resemblance to *Uruguaya coralloides* and to *Lubomirskia baicalensis*, and it also contains in quantity in its spiculation the curved cylindrical form of spicule common to them. The points of resemblance, or, it may be, of relationship, therefore, between these marine and fresh water species seem well worth recording.

L. M. B. C., No. 85. 6. Collected at Hilbre Island.

L. F. M., No. 32. 12. 69. 40. Type specimen. Collected on the Mersey shore, at Egremont, in 1869.

Isodictya elegans, Bk.

Dr. Bowerbank figures three fragments, as type specimens of this species.† Professor Herdman obtained one specimen at Port Erin, of reptant growth; but in a shore pool where the sponge was protected and could grow freely, he obtained two nice complete specimens of erect growth, tubular and branched. The colour of these when taken was lilac pink, a colour which is seen in some species of *Chalina*, and which, coupled with other characters common to both, may be regarded as indicating a relationship between

* *Mon. Brit. Spong.*, vol i, pl. xx, fig. 309; for skeletal network of spicules, vol. ii., p. 281; vol. iii., pls. xlviii and lxxxviii.

† *Mon. Brit. Spong.*, vol. ii, p. 283, and vol. iii, pl. xlix, figs. 1–5.

the genera *Isodictya* and *Chalina*. Professor Herdman's specimens abound with ova in an advanced state of duplicate sub-division, and ciliated embryos. They were obtained in July and August.

L. M. B. C., No. 85. 7. In shore pool, Port Erin, Isle of Man; also dredged near Port Erin.

Isodictya simulans, Bk.*

This is a compact form of *Isodictya* of pretty well marked character, and, therefore, is more easily recognised than many species of the genus. Its spicules are short, rather stout, acerates. It is usually found of a branching growth, but it is polymorphous.

L. F. M., No. 24. 5. 73, 16. Collected at Douglas Bay. V.

Isodictya pallida, Bk. †

The colour of this sponge is pale grey, or cream. Its spicules are stout and very slender acerates. It is of massive coating growth, and is not difficult to recognise.

L. F. M., No. 24. 5. 73. 7. Collected at Douglas Bay. V.

Isodictya densa, Bk. ‡

This is a massive spreading growth with stout acerate spicules.

L. F. M., No. 24. 9. 73, 2. Collected at Holyhead. V.

L. M. B. C., No. 85. 19. Collected at Port Erin.

Isodictya fistulosa, Bk. §

This is a massive form throwing up thin-walled tubes or fistulæ. Its colour alive is white, with a pinkish tint. Its spicules are two kinds of acerates, the one fairly stout and the other very slender.

L. F. M., No. 4. 9. 74, 10. Collected at Holyhead. V.

* *Mon. Brit. Spong.*, vol. ii., p. 308; vol. iii, pl. 51.
† *Op. cit.*, vol. ii, p. 297; vol. iii, pl. 50.
‡ *Op. cit.*, vol. ii, p. 292; vol. iii, pl. 50.
§ *Op. cit.*, vol. ii, p. 299; vol. iii, pl. 53.

Isodictya clava, Bk. *

The examples collected at Douglas Bay were long slender stems, about a couple of inches long, with a diameter of a line or less, sometimes branched; the specimens figured by Dr. Bowerbank have the appearance of immature forms. The spicules are rather short stout acerates.

L. F. M., No. 2. 5. 9. 73, 8. Douglas Bay. V.

Isodictya fucorum, Bk. †

This is a pink or red coloured sponge, of amorphous growth, with acerate spicules and an equianchorate flesh spicule.

L. F. M., No. 24. 5. 73, 12. Douglas Bay. V.

Group Halichondrina.

Halichondria incrustans, Johnston.

In the preceding species of the orders IV, V, and VI, which produce spicules, we have been dealing generally with sponges having simple acerate or acuate spicules, but in *H. incrustans* ‡ we have a species supplied abundantly with flesh spicules, in addition to the spicules of the skeleton which consist of smooth or spined acuates and curved or straight cylindrical forms, sometimes inflated at the ends, sometimes pointed and microspined near the ends. The flesh spicules are C-shaped, bihamate and equianchorate. Mr. Carter has made this sponge representative of the group Halichondrina. It is of wide distribution, having been found in the West Indies, the Falkland Islands, and in other parts of the world. In one example, the spined acuate is

* *Mon. Brit. Spong.*, vol. ii, p. 316; vol. iii, pl. 53.

† *Op. cit.*, vol. ii, p. 322; vol. iii, pl. 56.

‡ See *Johnston's Brit. Spong.*, p. 122, pl. xii, fig. 3; *Mon. Brit. Spong.*, vol. ii, p. 249, and vol. iii, pl. xliv, fig. 7-12.

found echinating the skeleton fibre, thus bringing this variety into Mr. Carter's order Echinonemata.

L. M. B. C., No. 85. 8. Collected at Port Erin, Isle of Man.

L. F. M., No. 4. 9. 74, 5. Collected at Holyhead.

Esperia cegagropila, C.

Desmacidon cegagropila, Bk.
Halichondria cegagropila, Bk.

This species* is also the British representative of a large group of wide distribution, the genus *Esperia* of Nardo. The skeleton spicule is a sub-pin-like form, the inflated end of which is usually of less diameter than the shaft, and the flesh spicules are bihamate, tricurvate, and inequianchorate. A characteristic feature of the genus is a beautiful polygonal lace-like dermal reticulation covering the surface, by which examples are readily recognised.

L. F. M., No. 18. 10. 73. 4. Collected at Holyhead.

Family.—Suberitida.

Cliona celata, J.

Raphyrus griffithsia, Bowerbank.

Johnston described two varieties of this sponge, one "massive," the other "sinuous." The massive variety Dr. Bowerbank made a new genus for, and named it *Raphyrus griffithsia;* the sinuous variety, that found boring into shells, he placed in his genus *Hymeniacidon*, as *Hymeniacidon celata*. Mr. Carter has found Johnston's view more correct than that of Bowerbank, and asserts that the sinuous form becomes the massive form. In support of this view, from a large number of examples of this sponge (which is

* Johnston's *Brit. Spong.*, p. 119, pl. xi, fig. 1; *Mon. Brit. Spong.*, vol. ii, p. 352; vol. iii, pl. lxiii, figs. 8–14; pl. lxxxiii, fig. 23. *Spongienf. Atlan.*, Schmidt, 1852, pp. 53–57, pl. v, figs. 2–8, 14.

very abundant all around our coast), it is said that one may select gradations of every variety of form, from the shell bored with small circular holes, through various stages during which the shell becomes more and more perforated and the sponge grows over it, surrounds it and encloses it, until it reaches the massive free form christened by Dr. Bowerbank *Raphyrus griffithsia*. On the other hand, however, Schmidt makes *Raphyrus griffithsia* equal to his *Papillina suberea*.

This species* belongs to the large family Suberitida, which embraces another sponge (*Suberites suberea*, see below) common on our coasts surrounding shells of various sizes, and in fact, in some instances, converting the shell into sponge substance, whilst to some extent the form of the shell is retained. The characteristic form of spicule is "pin-like." The well-known "Neptune's Cup" sponge *Raphiophora patera* (Gray), also belongs to this group.

L. M. B. C., No. 85. 9. Collected at Port Erin.

L. F. M., No. 9. 2. 75. 6. Collected at Holyhead.

Suberites suberea, S.

Hymeniacidon suberea, Bk.

Halichondria suberea, J.

This is the species† alluded to in the notes on *Cliona celata* as surrounding shells. It is the *Suberites domuncula* of Schmidt, and is representative of the compact forms (group Compacta) of the family.

L. F. M., No. 15. 6. 62. Collected at Holyhead, Liverpool Bay, and Morecambe Bay.

Suberites carnosa, S.

Hymeniacidon carnosa, Bk.

Halichondria carnosa, J.

This is another Suberite of compact form. The spicules

* Johnston's *Brit. Sponges*, p. 125; *Mon. Brit. Spong.* vol. ii, p. 212; vol. iii, pl. xxxviii, and pl. lxiv; *Spongf. Atlan.*, p. 65.

† Johnston's *Brit. Spong.*, pp. 139-141, pl. xii, figs. 5, 6; *Mon. Brit. Spong*, vol. ii, p. 200; vol. iii, pl. xxxvi, figs. 1-4; *Spongf. Atlan.*, p. 67.

are very similar to those of *S. suberea*, but the growth of the sponge is different, and the surface is more hispid.*

L. M. B. C., No. 85. 10. Collected at Hilbre Island.

Hymeniacidon sanguinea, Bk.
Halichondria sanguinea, J.

This species† Schmidt places in his genus *Amorphina*, but Mr. Carter places it in the family Suberitida, though the spicules are acuate and not pin-like, with the remark that Bowerbank found on Johnston's type specimen in the the British Museum, No. 47. 9. 7. 19, flesh spicules (which, however, he does not appear to have regarded as belonging to the specimen) like those of *Vioa johnstonii*, Schmidt, a Suberite. Mr. Carter has placed it in his group Laxa, which also contains *Vioa johnstonii*.

L. M. B. C., No. 85. 11. Collected in tidal pools near Port Erin.

L. F. M., No. 24. 5. 73. 10. Collected at Holyhead and Douglas Bay. V.

Family.—Pachytragida.

Pachymatisma johnstonia, Bk.

This sponge belongs to a family quite different from any previously considered in these notes. It has a crustular surface,‡ and is embraced in Mr. Carter's family Pachytragida, which also contains the genera *Geodia* (Lamarck), *Tethya* (Johnston), and *Stelletta* (Schmidt). It corresponds with Schmidt's group Corticatæ. The pachytragous sponges possess the various forms of four rayed spicules (quadrira-

* See Johnston's *Brit. Spon.*; *Mon. Brit. Spong.*, vol. ii, p. 203; vol. iii, pl. xxxvi.

† Johnston's *Brit. Spong.*, p. 133, pl. xiv, fig. 3; *Mon. Brit. Spon.*, vol. i, p. 239, pl. iii, fig. 72; vol. ii, p. 168; vol. iii, pl. xxxii, fig. 5–8.

‡ See *Mon. Brit. Spong.*, vol. i, pl. xxvii, fig. 353; vol. ii, p. 51; vol. iii, pl. viii, figs. 1–7. *Annals*, 1869, vol. iv, p. 8, pl. ii, figs. 7, etc.

diate). The crust in the genus *Geodia* consists of globular or ellipsoidal siliceous bodies closely packed together, upheld by the short arms of the four rayed spicules. The species of *Stelletta* have no globular siliceous bodies on the surface, but have a thick dermal layer of cells charged with the stellates of the species, whilst the surface of the genus *Tethya* is hirsute with tufts of spicules projecting through the dermal layer.

L. F. M., No. 4. 9. 74, 2 (spirit). Collected at Holyhead.

Stelletta grubii, Schmidt.

This species is described by Schmidt in his Atlantic Sponges,* and has also been found by Mr. Carter at Budleigh Salterton.

L. F. M., No. 4. 9. 74, 6. Collected at Holyhead.

Ecionema ponderosa, Bk.

This is no doubt the same sponge which Mr. Carter described in 1871 as *Stelletta aspera*. It is undoubtedly a species allied to *Stelletta*.†

L. F. M., No. 4. 9. 74, 3. Collected at Holyhead.

Family.—PACHASTRELLIDA.

Dercitus niger, C.

Hymeniacidon bucklandi, Bk.
Battersbyia bucklandi, Bk.

Before issuing his third volume in 1874, Dr. Bowerbank removed this sponge from his genus *Hymeniacidon* and created a new genus for it, *Battersbyia*, and gave a section of it in one of his illustrations. It had been, however, more particularly described and figured by Mr. Carter in 1871 as

* *Spongf. Atlan.*, 1862, p. 46, pl. iv, fig. 2.

† *Mon. Brit. Spong.*, vol. ii, p. 56, and vol. iii, pl. viii, fig. 8–15; *Annals and Mag. Nat. Hist.*, 1871, vol. vii, p. 7, pl. iv, fig. 7, etc.

Dercitus niger.* This is the sponge which Dr. Bowerbank likened in appearance to a piece of bullock's liver.

Mr. Carter has included it in his family Pachastrellida, which embraces Schmidt's genus *Pachastrella*, and the Lithistid, or stony sponges.

L. F. M., No. 4. 9. 74, 4. Collected at Holyhead.

Order VIII.—CALCAREA.

The only monograph of the Calcarea or sponges which have calcareous spicules is that published by Professor Haeckel† in 1872. Previous and subsequent writers have described a few species only, but Haeckel had a large number before him. There has been a general concurrence in his classification, though exceptions have been taken to some of his views and speculations. The Calcarea of the "Challenger" Expedition were examined and reported upon by Dr. N. Polejaeff,‡ of the University of Odessa, a distinguished pupil of Professor F. E. Schultze; and, at the present moment, Mr. H. J. Carter, F.R.S., of Budleigh Salterton, has under examination a very large collection from Australian waters. Dr. Polejaeff had only a few species to report upon.

Professor Haeckel divided the whole order into three families, Ascones, Leucones, and Sycones, according to the canal system, and these again into groups and genera, according to the prevailing forms of spicules. "The Ascones present the simplest form of the canal system. The thin wall of the sponge consists of three parallel layers, ectoderm, mesoderm, and endoderm. Here and there the cells separate, and thus give origin to the pores" (Vosmaer.) The

* *Mon. Brit. Spong.* vol. ii, p. 226; vol. iii, pl. xxxviii, fig. 9-12, and pl. xcii, fig. 8, p. 346. *Annals and Mag. Nat. Hist.*, 1871, vol. vii, p. 3, pl. iv, fig. 1, etc. *Proc. Zool. Soc.*, 1867, p. 542.

† *Die Kalkschwämme*, Haeckel, 1872.

‡ *Report on the Calcarea*, by Dr. N. Polejaeff, M.A., Zool. Chall. Exp., part xxiv, 1883.

Leucones are those with branched canals, and the Sycones those with a radial canal system. Polejaeff does not agree with Haeckel's distinction of Leucones from Sycones, but proposes to group the Ascones in one order, Homocœla, and both the others in another order, Heterocœla, treating the Calcarea as a separate Class.

The Calcarea found on our coasts are usually very small. I have never found an example of *Sycandra compressa* more than one-and-a-half inches in length, but Dr. Bowerbank speaks of one from Ipswich River five inches long by three-and-a-quarter broad. *Sycandra ciliata* is generally a quarter to half an inch in length, but Ipswich River produced one for Dr. Bowerbank three inches long by three-quarters of an inch in diameter. The size evidently depends on the locality being favourable for growth or otherwise.

Family.—Ascones.

Ascaltis botryoides, H.

Leucosolenia botryoides, Bk.
Grantia botryoides, Fleming and Johnston.

The specific name is descriptive of the way in which a number of individuals of the species are found congregated together in branches or tufts.* Colour white.

L. F. M., No. 25. 9. 73. 3. Collected at Holyhead.

Ascetta coriacea, H.

Leucosolenia coriacea, Bk.
Grantia coriacea, Fleming and Johnston.

This is a pretty encrusting species.† Colour greyish white or dark crimson, or lemon yellow or nut brown.

* *Mon. Brit. Spong.*, vol. ii, p. 28; vol. iii, pl. iii, figs. 1–4. *Die Kalkschwämme*, vol. ii, p. 65; vol. iii, taf. 9, fig. 10.

† *Mon. Brit. Spong.*, vol. ii, p. 34; vol. iii, pl. iii, fig. 11–14. *Die Kalkschwämme*, vol. ii, p. 24; vol. iii, taf. 3.

L. M. B. C., No. 85. 12. Collected at Port Erin, Isle of Man. L. F. M., No. 22. 4. 74. 6. Collected at Holyhead.

Family.—Leucones.

Leucandra gossei, H.

Leucogypsia gossei, Bk.

This is a massive sessile species.*

It is readily recognised by the large acerate spicules lying longitudinally on its surface. Colour white.

L. M. B. C., No. 85. 13. Collected at Port Erin, Isle of Man.

L. F. M., No. 22. 4. 74. 3. Collected at Holyhead.

Leucandra nivea, H.

Leuconia nivea, Bk.

Grantia nivea, Fleming and Johnston.

Coating smooth or lobular.† Colour white.

L. M. B. C., No. 85. 14. Collected at Port Erin, Isle of Man.

L. F. M., No. 25. 9. 73. 4. Collected at Douglas Bay.

Leucandra johnstonii, H.

Leuconia johnstonii, C.

Mr Carter says, a good feature for recognising the species is the large four-rayed surface spicule with a dark centre, the dark centre being the fourth ray, or shaft, penetrating the sponge substance.‡ Colour white.

L. M. B. C., No. 85. 15. Collected at Port Erin, Isle of Man.

L. F. M., No. 26. 8. 82. 1. Collected at Holyhead.

* *Mon. Brit. Spong.*, vol. ii, p. 42; vol. iii. *Die Kalkschwämme*, vol. ii, p. 177; vol. iii, taf. 37.

† *Mon. Brit. Spong.*, vol. ii, p. 36; vol. iii, pl. v, fig. 1-8. *Die Kalkschwämme*, vol. ii, p. 211; vol. iii, taf. 39.

‡ *Annals and Mag. Nat. Hist.*, 1871, ser. iv, vol. viii, p. 3, pl. i, figs. 5-12. *Die Kalkschwämme*, Haeckel, vol. ii, p. 216, pl. 34.

Leucandra fistulosa, H.*
Grantia fistulosa, J.
Leuconia fistulosa, Bk.

L. M. B. C., No. 85. 16. Collected at Port Erin, Isle of Man.

Family.—Sycones.

Sycandra compressa, H.
Grantia compressa, Fleming.

This is a very easily recognised species from its hollow compressed form; it is found in quantity all round our coasts attached to seaweed. It is well figured both by Haeckel and Bowerbank.†

L. M. B. C., No. 85.17. Collected at Port Erin, Isle of Man.

L. F. M., No. 22. 4. 74. 2. Collected at Holyhead.

Sycandra ciliata, H.‡
Grantia ciliata, H.

L. M. B. C., No. 85. 18. Collected at Port Erin, Isle of Man.

L. F. M., No. 22. 4. 74. 4. Collected at Holyhead.

DESCRIPTION OF A NEW SPECIES BY H. J. CARTER, F.R.S.

Aphroceras ramosa, n.sp.

Small, cylindrical, branched, sessile; branchlets more or less acuminated, horn-shaped; without peristome. Colour whitish-yellow. Surface even, consisting of long, large, fusiform acerates arranged parallel to each other and closely

* *Mon. Brit. Spong.*, vol. ii, p. 39; vol. iii, pl. v, figs. 9–16. *Die Kalkschwämme*, Haeckel, vol. ii, p. 197; vol. iii, pl. 31.

† *Mon. Brit. Spong.*, vol. ii, p. 17; vol. iii, pl. i. *Die Kalkschwämme*, vol. ii, p. 360; vol. iii, taf. 57.

‡ *Mon. Brit. Spong.*, vol. ii, p. 19; vol. iii, pl. ii, figs. 1–15. *Die Kalkschwämme*, vol. ii, p. 296; vol. iii, taf. 58, fig. 9.

approximated, on the same plane, more or less covered by small sagittiform triradiates. Pores situated in the interstices between the arms of the triradiates, along the intervals of the large acerates. Vent single, at the end of each branch, naked, *i.e.*, without peristome; leading into a cylindrical, cloacal cavity, about the same shape as the sponge, and equally branched; presenting on its surface a great number of circular holes in juxtaposition, rendered more or less polygonal by the intercrossing of the rays of the radiates that form the skeletal structure of the cloaca, which is sparsely echinated by the fourth ray of the quadriradiates. Wall consisting of simple, cancellated sarcode, traversed horizontally, at intervals, by the shafts of large, sagittiform triradiates which, coming from opposite sides and overlapping each other, have their heads in the internal surface of the cortex and that of the cloaca respectively.

Spicules of three kinds, viz., acerate, triradiate, and quadriradiate. 1st, acerate, very large, long, fusiform, slightly curved, and often lance-pointed anteriorly, averaging $\frac{1}{9}$th inch long by $\frac{1}{2\,2\,7}$th inch in its greatest transverse diameter; 2nd, triradiates, small and large, the latter averaging $\frac{1}{1\,8\,0\,0}$ by $\frac{1}{1\,8\,0\,0}$th inch in the shaft, and the arms respectively $\frac{2}{3}$rds of this size; 3rd, quadriradiates, of the same size as the large triradiates, with the addition of the fourth arm which is short and curved, about $\frac{3}{1\,8\,0\,0}$ths inch long. No. 1 is confined to the surface with the arrangement before stated; No. 2 in its larger form, to the wall, also as above stated; and the smallest, which are chiefly sagittiform, to the outer and inner surfaces; No. 3 to the inner part of the cloaca, where they are formed by the addition of the fourth arm to the heads of the large triradiates of the wall which abut against this part; thence projecting into the cavity of the cloaca. Size of specimen, which is much broken, under $\frac{1}{1\,2}$th inch in the diameter of the stem; length unknown; longest

fragment $\frac{6}{10}$ths of an inch; thickness of the wall, including the cortex and the cloaca, about $\frac{1}{3}$th inch.

L. F. M., No. 22. 4. 74. 7. Collected at Holyhead.

This species in spiculation is very much like *Leucogypsia gossei*, Bowerbank, who, when he made a genus of it under the name of "*Leucogypsia*" in 1862 (*Phil. Trans.*, p. 1095), stated that he had not seen another species in Great Britain. In 1858, Dr. J. E. Gray described and illustrated a cylindrical branched species from Hong Kong, to which he gave the name of *Aphroceras alcicornis* (*Proc. Zool. Soc.*, Lond., p. 114, pl. x, figs. 1 and 2), and in 1867 (*Ib.*, p. 558) he made a family for it under the name of "Aphrocerasidæ." This species is closely allied in form to that discovered by Mr. Higgin, but differs greatly in structure; while the structure of *A. alcicornis* is almost identical with that of *Leucogypsia gossei*, hence Haeckel has placed them among his Leucones; but the structure of *Aphroceras ramosa* is Syconid, and belongs to a genus which I have named "*Heteropia*" in my forthcoming description of the Calcareous Sponges from the neighbourhood of Port Phillip Heads, S. Australia, sent to me by Mr. Bracebridge Wilson; meanwhile, Haeckel's illustration of the "Radial-tuben," in his *Sycilla cylindrus*, represents it well (*Die Kalkschwämme*, Atlas, taf. 43, fig. 6).

Note.—A species of *Sycandra*, probably new to science, was also dredged near Port Erin, Isle of Man. It has been examined by Mr. Harvey Gibson, and his description and figures will be found further on in this volume.—Ed.

REPORT on the HYDROIDA of the L. M. B. C. DISTRICT.

By Mr. W. R. Melly, J. Sibley Hicks, L.R.C.P., F.L.S., and Prof. Herdman, D.Sc.

A few words of explanation are necessary in regard to the joint authorship of this Report. Before the Liverpool Marine Biology Committee commenced their investigations, Dr. Sibley Hicks had done a good deal of work at the Hydroid Zoophytes of this neighbourhood, and had drawn up a list of thirty-eight species found in the estuary of the Mersey. This list was exhibited before the Literary and Philosophical Society of Liverpool, in 1880, but has not been published. As Dr. Hicks found that he could not spare sufficient time to undertake the Report upon the Hydroida, he handed over his list of species to the Committee, and has also given some assistance in identifying the specimens.

Mr. W. R. Melly, while working as a student in the Zoological Laboratory of University College, paid special attention to the Hydroids, and on the dredging expeditions which he took part in, he assisted me in collecting and preserving the smaller species of Zoophytes. Consequently, when it was found that Dr. Hicks could not undertake the preparation of this Report, I handed the collections over to Mr. Melly for examination. The work has been carried on during the present Winter Session in the Laboratory, under my direction. The greater part of the labour of preparing the Report has, then, been performed by Mr. Melly. He has examined and identified every specimen in the collection, and has drawn up the list of species, with records of their previous occurrence in the locality. My share of the work has been

confined to a general supervision of Mr. Melly's investigations, and some assistance in identifying the more difficult species.

W. A. HERDMAN.

The Hydroida are well represented in the neighbourhood of Liverpool, and are especially abundant on the shores of Hilbre Island. Former investigators in this locality have paid more attention to the Zoophytes than to most other groups of animals, and consequently there are comparatively few species to add to the existing lists as the result of the Committee's dredging investigations. Mr. Byerley, in his *Fauna*, published in 1855, records thirty-three species, of which twenty-six have been found by members of the Committee during 1885; fifteen of the species previously recorded from this neighbourhood have not been found during 1885. Dr. Sibley Hicks records thirty-eight species, including six not mentioned by Byerley, in his list drawn up in 1880. A few localities within the L. M. B. C. District have been given by Hincks, Allman, and Pennington in their works on the Hydroid Zoophytes. Mr. A. O. Walker, of Chester, has furnished us with records of the species which he has found in the neighbourhood.

The large collections made by the Liverpool Marine Biology Committee yielded forty-two species, eleven of which had not been previously recorded from this neighbourhood. Seven of the species were collected at Hilbre Island, sixteen were from various parts of Liverpool Bay, seven were obtained during the cruise of the "Hyæna," seven were obtained at Penmaenmawr by Mr. Thompson, and thirty were collected off the south end of the Isle of Man by Professor Herdman.

The classification and nomenclature of species given by Mr. Hincks * have been followed.

* *History of the British Hydroid Zoophytes*, van Voorst, London, 1868.

Order.—HYDROIDA.

Sub-order I.—ATHECATA.

Family I.—Clavidæ.

Clava multicornis, Forskal.

Clava discreta, Allman, *Ann. N. H.*, Nov., 1859.

Recorded by Byerley as having been found on floating *Fuci* by Mr. Price. Mersey (J. S. Hicks).

Found at Hilbre Island, May 17th, 1885, and June 13th, 1885, on the under surfaces of stones. The specimens found on May 17th had gonophores.

Some of these specimens, obtained at Hilbre Island, lived in the laboratory at University College in a small 1-oz. bottle of sea water for over six months. A few specimens were obtained at the south end of the Isle of Man adhering to *Corallina officinalis*.

Clava leptostyla, Agassiz.

Mentioned by Hincks as being found at Morecambe Bay. Also recorded by Allman from the same locality.

Family II.—Hydractiniidæ.

Hydractinia echinata, Fleming.

Alcyonidium echinatum, Johnston, *B. Z.* (1st. edit.) 304, pl. xiii, figs. 3, 4.

Recorded by Byerley. Mersey (J. S. Hicks).

Dredged at Hilbre Swash, June 20th, 1885, from a depth of ten fathoms; also dredged on the Constable Bank, near Llandudno, during the cruise of the "Hyæna," May 23rd, 1885. Found by Mr. Thompson at Penmaenmawr, and at Point of Ayr by Mr. A. O. Walker; in all cases on shells inhabited by Hermit Crabs.

Family V.—Corynidæ.

Coryne sp. (?).

A species of *Coryne* was found attached to masses of wood at the breakwater, near Port Erin, Isle of Man, in August,

1885. The specimens are not in the collection, and are recorded on the authority of Prof. Herdman, who examined them in a living condition.

Coryne pusilla, Gaertner.

Recorded by Byerley as being found on the Dingle rocks by Mr. Price. Mersey (J. S. Hicks). Hilbre Swash (A. O. Walker). Bangor (A. S. Pennington).

Found at Hilbre Island, June 13th, 1885. The specimens are not in the collection, but the species was identified and recorded at the time.

Family IX.—Eudendriidæ.

Eudendrium rameum, Pallas.

Tubularia ramosa, Johnst. *Trans. Newc. Soc.*, ii, 253, pl. x.
E. rameum, Johnst. *B. Z.* (2nd edit.) 45, pl. v, figs. 1, 2, &c.

Recorded by Byerley. Mersey (J. S. Hicks). Mentioned by Hincks as being plentiful at Lytham. Recorded by Allman from Morecambe Bay.

Eudendrium ramosum, Linnæus.

Recorded by Byerley as having been found on Bootle shore by Mr. Marrat. Mersey (J. S. Hicks). Common in the district (A. O. Walker). Mentioned by Allman as being found at Morecambe Bay.

One large colony, growing on a stone, was dredged off the south end of the Isle of Man from a depth of ten to twenty fathoms, during August, 1885. This specimen resembles the figures given both by Hincks and by Allman, but it has no gonophores.

Eudendrium capillare, Alder.

Corymbogonium capillare, Allman, *Ann. N. H.* for August, 1861, p. 168.

Found at Colwyn Bay in September, 1882, by Mr. A. O. Walker.

One colony, about 1½ inches in height, attached to the back of a specimen of *Hyas coarctatus*, and a second colony, about 2½ inches in height, were dredged off the south end of the Isle of Man, in August, 1885, from a depth of ten to twenty fathoms. Gonophores are present in both.

Neither Hincks nor Allman give any very good distinguishing characteristics by which *E. capillare* can be known from *E. ramosum*. The colonies of the former species seem to branch more irregularly, and, according to Allman, they develop gonophores between June and September, while in *E. ramosum* these are produced in April. The Manx specimens were obtained in August and have the gonophores well developed: they probably belong to *E. capillare*.

Family X.—Atractylidæ.

Garveia nutans, T. S. Wright.

Eudendrium (Corythamnium) bacciferum, Allman, "Notes on Hydroid Zoophytes," *Ann. N. H.*, July, 1859.

This rare Zoophyte was first found by Dr. Strethill Wright on the island of Inch Garvie, in the Firth of Forth, and almost simultaneously by Prof. Allman in the same locality (see Allman, *Gymnoblastic Hydroids*, p. 294). It has since been found in Shetland by Hincks, and at Morecambe Bay by Allman. It had not been previously found in Liverpool Bay, but last summer, during the expeditions of the Liverpool Marine Biology Committee, it was discovered in several localities, and seems to be fairly abundant now off the north end of Hilbre Island. It was found at low water on Hilbre Island on May 17th, with well developed gonophores; at the same locality, on June 13th; and was dredged in Hilbre Swash on May 9th, and again on June 20th, from depths of ten fathoms. It was also obtained during the cruise of the "Hyæna," on May 25th, off the Great Ormes

Head. It was found living at Colwyn Bay on drift stuff on April 19th, 1885, by Mr. A. O. Walker.*

Bimeria vestita, T. Strethill Wright.

This species is mentioned by Allman as having been found at Morecambe Bay.

Bougainvillia muscus, Allman.

Found at Colwyn Bay on April 27th, 1884, by Mr. A. O. Walker.

Family XI.—TUBULARIIDÆ.

Tubularia indivisa, Linnaeus.

Recorded as being very abundant by Byerley. Mersey (J. S. Hicks).

Dredged in the Welshman's Gut, June 20th. Found growing at Hilbre Island in large quantities, near low water mark. Dredged in Hilbre Swash on June 20th, depth ten fathoms. Dredged off the Great Ormes Head, from seven to eight fathoms, during the cruise of the "Hyæna," May 23rd, 1885.

Tubularia coronata, Abildgaard.

Tubularia larynx, var. β, Johnst., *B. Z.* (1st edit) 116.

Mersey (J. S. Hicks). Mentioned by Hincks as being plentiful at Lytham.

Some dried stalks, which are probably those of *T. coronata*, were dredged in Welshman's Gut, on June 20th, from a depth of seven fathoms.

Collected at low water on Hilbre Island, on June 13th.

Tubularia simplex, Alder (?).

Tubularia dumortierii, Johnst., *B. Z.* 50.

A specimen which was dredged from deep water between Port St. Mary and the Calf, off Spanish Head, Isle of Man, on August 3rd, 1885, probably belongs to this species.

* *Garveia nutans* has also been recently found on Dalkey Island, Dublin Bay, by Prof. Haddon (see *Proc. R. I. Acad.*, ser. ii, v. iv, p. 524.)

Tubularia larynx, Ellis and Solander.

Recorded by Byerley as being very common round the coast. It has not been found during our investigations, and is not mentioned by Dr. Sibley Hicks. Possibly it may have been *T. coronata*.

Tubularia britannica, Pennington.

This species was found by Mr. Pennington in the Menai Straits.

Ectopleura dumortierii, Van Beneden.

Tubularia dumortierii, Johnst., *B. Z.* pl. vii, figs. 1, 2 (not the species described in the text).

Mentioned by Allman as being found at the Isle of Man, and recorded by Pennington from Point of Ayr.

Corymorpha nutans, Sars.

Mersey (J. S. Hicks). Isle of Man (Pennington).

Sub-order II.—THECAPHORA.

Family I.—Campanulariidæ.

Clytia johnstoni, Alder.

Companularia volubilis, Johnst., *B. Z.* 107, 108, woodcut fig. 18.
Campanularia johnstonii, Allman, *Proc. Roy. Soc. Ed.*, for Dec. 6th, 1858.

Hilbre Swash and Abergele Bay (A. O. Walker). Mersey (Hicks).

Several very large colonies were dredged during August, 1885, off the south end of the Isle of Man, in the neighbourhood of Port Erin. One well-developed colony was attached to the siphons of a specimen of *Molgula occulta*. Another colony, with gonothecæ, was found adhering to the stalk of a *Tubularia*. A third colony from the Isle of Man differed considerably from the typical condition. It was of much smaller size, and the calycles were much longer and

narrower than is shewn in Hincks' figure. It may be regarded as a small variety of the species.

Possibly this is the species mentioned by Byerley under the name of *Campanularia volubilis*.

Obelia geniculata, Linnaeus.

Recorded by Byerley under the name of *Laomedea geniculata*, as being very abundant upon Algæ, dead shells, &c. Mersey (J. S. Hicks).

Obelia gelatinosa, Pallas.

Recorded by Byerley under the name of *Laomedea gelatinosa*, as being common. Found in Hilbre Swash on July 2nd, 1872, by Mr. A. O. Walker. Liverpool (Collingwood). Menai Straits (Pennington).

This species is recorded by Hincks as being very common on the Dingle rocks, Egremont, Hilbre Island, and other places near Liverpool, in 1868. Mersey (J. S. Hicks).

One colony of this species, about $2\frac{1}{2}$ inches in height, was obtained at the south end of the Isle of Man, August, 1885. This colony differs from Hincks' figure and description in having the margins of the hydrothecæ distinctly *not* denticulated. The hydrothecæ are very thin, and the edges are slightly ragged in some cases, but never denticulated. In all other respects the zoophyte agrees with Hincks' description.

Obelia longissima, Pallas.

Laomedea dichotoma, var. β, *B. Z.* p. 102.

Found off the Little Ormes Head on June 22nd, 1880, by Mr. A. O. Walker. Recorded from Blackpool by Pennington.

Obelia flabellata, Hincks.

Campanularia flabellata, Hincks, *Ann. N. H.* (3rd series), xviii, 297.

Not previously recorded from this neighbourhood.

This species was found at Hilbre Island on June 13th, 1885. Several colonies were also obtained from the Isle of Man, growing on the stalk of a *Tubularia*. Some of these specimens have gonothecæ.

A specimen, which was dredged off the Isle of Man in August, 1885, resembles Hincks' figure in most respects, but is a little less zigzag in its growth, though not so straight as *O. dichotoma*. Hincks figures three rings above each joint; our specimen has only one. Hincks does not mention the presence of tendrils in the species, while our specimen shews several. The hydrothecæ spring in some cases from the axils, a condition which Hincks mentions in his description of *Obelia dichotoma*, but not in the case of *O. flabellata*.

Obelia dichotoma, Linnaeus.

Laomedea dichotoma, var. *a*, Johnst., *B. Z.* 102, pl. xxvi, figs. 1, 2.

Recorded by Byerley under the name of *Laomedea dichotoma*, as growing in small tidal pools. Mersey (Hicks).

Several small colonies were obtained off the south end of the Isle of Man; no gonothecæ were present. One small colony, also without gonothecæ, was found at Penmaenmawr, by Mr. Thompson. One of the specimens showed tendrils like those figured by Hincks for *Campanularia angulata*.

A colony found at Hilbre Island on June 13th, is mentioned in the notes taken at the time, as being probably *O. dichotoma*, and is recorded as having had medusoid gonophores attached.

Campanularia volubilis, Linnaeus.

Recorded by Byerley as "Adhering to shells and Fuci in pools on the shores." Mersey (J. S. Hicks). Point of Ayr (A. O. Walker).

Several small colonies were dredged off the south end of

the Isle of Man during August. They were adhering both to the stalks of *Tubularia* and also to colonies of *Sertularia filicula*. None of these specimens had gonothecæ.

Campanularia hincksii, Alder.

Campanularia volubilis, var., Hincks, *Ann. N. H.* (2nd ser.) xi, p. 180.

Several colonies, attached to the stalks of *Tubularia*, were dredged off the south end of the Isle of Man, in August, 1885. They had gonothecæ.

Campanularia caliculata, Hincks.

Several small colonies of this species were obtained off the south end of the Isle of Man, from depths of ten to twenty fathoms, during August, 1885.

Campanularia verticillata, Linnaeus.

Recorded by Byerley as being very common. Mersey (J. S. Hicks). Common in the neighbourhood (A. O. Walker).

Two colonies, about 2½ inches in height, were dredged at Penmaenmawr in July, 1885, by Mr. Thompson.

One large colony, about 3 inches long, was dredged between Port St. Mary and the Calf, off Spanish Head, Isle of Man, in ten to twenty fathoms, August, 1885.

Campanularia flexuosa, Hincks.

Laomedea gelatinosa, Johnst., *B. Z.* 105, pl. xxv, figs. 3, 4.
Laomedea flexuosa, Hincks, *Devon and Cornw Cat.*, *Ann. N. H.* (3rd series), viii, 260. Allman, *Ann. N. H.* for May, 1864.

Mersey (J. S. Hicks). Mentioned by Hincks as being found at the Isle of Man. Point of Ayr (A. O. Walker).

Several colonies attached to sea-weeds and to the old stalks of *Tubularia*, were dredged at the south end of the Isle of Man in August, 1885. Some of them have gonothecæ.

Campanularia angulata, Hincks.

Recorded from the Menai Straits by Pennington.

A great many colonies attached to Algæ, were obtained at the south end of the Isle of Man, in August, 1885. The long claspers are present on several of the colonies.

Most of the specimens have the pedicels much shorter than those figured by Hincks. He describes the pedicels as consisting of nine to twelve rings, while those on most of our specimens have not more than six or seven. None of our specimens have gonothecæ.

Campanularia neglecta, Alder.

Found in Colwyn Bay on September 14th, 1878, by Mr. A. O. Walker.

Several colonies about $\frac{3}{10}$ inch in height were dredged at south end of Isle of Man in August, 1885. They are attached to a stalk of *Tubularia*, and have no gonothecæ.

Gonothyræa lovéni, Allman.

This species is not recorded by either Sibley Hicks or Byerley. It was found in Hilbre Swash on July 12th, 1878, by A. O. Walker; and has been recorded from the Menai Straits by Pennington.

Four colonies were dredged off the Isle of Man, in August, 1885. Two were attached to the stalk of a *Tubularia*, and the other two, about $\frac{3}{4}$-inch in height, were attached to Algæ.

Family II.—Campanulinidæ.

Operculariella lacerata, Johnston.

Campanularia lacerata, Johnston, *B. Z.* iii, pl. xxviii, fig. 3.
Laomedea lacerata, Hincks, *Ann. N. H.* (2 series), x, 86.
Calycella lacerata, Allman, *Ann. N. H.* for May, 1864, 31.

Mersey (J. S. Hicks). Mentioned also by Hincks as being found at the Isle of Man.

Family IV.—Lafoëidæ.

Lafoëa dumosa, Fleming.

Tubularia tubifera, Johnston, *Edin. Phil. Jour.*, xiii, 222, pl. iii, figs. 2, 3.

Calicella dumosa, Hincks, *Cat. Devon and Cornw. Zooph.* 23; *Ann. N. H.* (3rd series), viii, 293.

Recorded by Byerley under the name of *Campanularia dumosa* as being common, parasitic upon Zoophytes, &c. Mersey (J. S. Hicks). Colwyn Bay (A. O. Walker).

Dredged in Hilbre Swash on June 20th, 1885.

Several colonies were dredged at the south end of the Isle of Man in August, 1885.

Calycella syringa, Linnæus.

Campanularia syringa, Johnston, *B. Z.* 110, woodcut 19.

Recorded by Byerley, under the name of *Campanularia syringa*, as being fairly common. Mersey (J. S. Hicks). Hilbre Swash (A. O. Walker).

Very common on stalks of *Tubularia* off south end of Isle of Man. Found in Hilbre Swash, June 20th, 1885, depth ten fathoms.

This species seems to some extent to have taken the place of the other Zoophytes of its family in this neighbourhood as it is commoner than *Lafoëa dumosa*.

Filellum serpens, Hassall.

Reticularia serpens, Hincks, *Ann. N. H.* (2nd ser.) xviii, 469 (1856).

Mersey (J. S. Hicks).

Family VI.—Coppiniidæ.

Coppinia arcta, Dalyell.

This species has not been previously recorded from this neighbourhood.

It was dredged during the cruise of the "Hyæna," off the

Great Ormes Head, at a depth of seven to eight fathoms, on May 23rd, 1885, and was found at Colwyn Bay on June 13th, 1885, by Mr. Walker.

It was dredged from fifteen fathoms at the Isle of Man, off Port St. Mary, on August 3rd, 1885.

It has also been found cast ashore on the sands at West Kirby, opposite Hilbre Island.

Family VII.—Halecidæ.

Halecium halecinum, Linnaeus.

Recorded by Byerley as abundant. Mersey (J. S. Hicks). Very common (A. O. Walker).

Dredged in Hilbre Swash on June 20th, from ten fathoms.

Two large colonies, one male and the other female, both with gonothecæ, were dredged at Penmaenmawr, July, 1885.

Five colonies, without gonothecæ, and one female and two male colonies, with gonothecæ, were dredged off Port Erin, Isle of Man, in August, 1885.

In one of the male specimens from the Isle of Man, the gonothecæ are *not* "borne in rows on the upper side of the pinnæ;" but are borne at the base of the calycles, as in *H. beanii*. But in the latter species there is no pedicel to the gonotheca; while in our specimen a short pedicel of about two rings is always present. In all other respects our specimens agree with Hincks' description of *H. halecinum*.

Hincks mentions in his Appendix a colony of *H. beanii* dredged off the Isle of Man, which presents a curious modification of the gonothecæ; probably our abnormal specimen is similarly only an unusual condition of *H. halecinum*.

Halecium beanii, Johnston.

Thoa beanii, Johnston, *B. Z.* (1st edit.) 120, pl. iii, figs. 1, 2.

Mr. Walker states that this species is not uncommon in the district, and he has also found the variety mentioned by Hincks in his Appendix (p. 324).

Two small colonies without gonothecæ, dredged off the Isle of Man in August, 1885, resemble *H. beanii* more nearly than any other species. The hydrothecæ are mostly single-jointed, but some have two joints. The polypites are large. One large colony, about three inches in height, with male gonothecæ, about which I think there is not much doubt, was also obtained off the south end of the Isle of Man, in August, 1885.

Family VIII.—Sertulariidæ.

Sertularella polyzonias, Linnaeus.

Recorded by Byerley as not uncommon among drift seaweeds; seldom or ever found with living polypes. Mersey (J. S. Hicks). Little Orme, June, 1880 (A. O. Walker).

Several good colonies with gonothecæ were dredged off the south end of the Isle of Man, in August, 1885.

Dredged off Puffin Island and Anglesey, during the cruise of the "Hyæna" in May, 1885.

Sertularella rugosa, Linnaeus.

Recorded by Byerley as being parasitic on *Flustra foliacea*. Mersey (J. S. Hicks).

Found at Hilbre Island, attached to colonies of *Flustra foliacea*, on June 13th, 1885.

Diphasia rosacea, Linnaeus.

Sertularia rosacea, Johnst., *B. Z.* 64, pl. xi, fig. 1,; 468, fig. 83.

Recorded by Byerley under the name of *Sertularia rosacea*, as being found rarely at New Brighton and elsewhere, attached to *Plumularia falcata*. Mersey (J. S. Hicks). Found at Puffin Island in June, 1880 (A. O. Walker).

Several colonies were obtained from the Welshman's Gut during the "Spindrift" expedition, on June 20th, 1885.

A small colony, about half-an-inch in height, attached to the stalk of a *Tubularia*, along with some other zoophytes,

was dredged at the south end of the Isle of Man, in August, 1885.

Diphasia attenuata, Hincks.

Sertularia rosacea, Johnst., *B. Z.* 470.

Sertularia pinaster, var., Johnst., *B. Z.* 72, fig. C. D.

Sertularia attenuata, Hincks, "On New British Hydroida," *Ann. N. H.*, October, 1866 (3rd series), xviii, 298.

Several large colonies of this species were dredged from Hilbre Swash on May 9th, 1885.

Diphasia pinaster, Ellis and Solander.

Sertularia margareta, Johnston, *B. Z.* 72, 73, fig. 13.

Mr. Byerley records this species under the name of *Sertularia margareta* as being found at the mouth of the Mersey by Mr. R. A. Tudor, and at New Brighton by Mr. Marrat. Mersey (J. S. Hicks).

Diphasia tamarisca, Linnæus.

Sertularia tamarisca, Johnston, *B. Z.*, pl. xiii, figs. 2, 3, 4.

Recorded by Byerley under the name of *Sertularia tamarisca* as having been found on the Bootle coast by Mr. Tudor.

One small piece, about an inch in height, was dredged in Hilbre Swash, from ten fathoms, May 9th, 1885.

Sertularia pumila, Linnæus.

Recorded by Byerley as "having been found by Mr. Marrat between Seacombe and Egremont. Not common." Mersey (J. S. Hicks). Very common on *Fucus*, Colwyn Bay (A. O. Walker.)

One colony showing gonothecæ was dredged off the south end of the Isle of Man in August, 1885.

Found at Hilbre Island, on May 17th, with gonothecæ.

Diphasia fallax, Johnst.

Sertularia fallax, Johnst., *B. Z.* 2nd ed., p. 73.

Point of Ayr (A. O. Walker).

Sertularia gracilis, Hassall.

This species is recorded from Blackpool and from Bangor by Pennington.*

Sertularia operculata, Linnæus.

Recorded by Byerley as having been found without polyps by Mr. Marrat. Mersey (J. S. Hicks). Very common, dead (A. O. Walker).

A large number of colonies were obtained from Hilbre Swash on May 9th, 1885, and on June 20th; and also from the Welshman's Gut, on June 20th.

Dredged during the cruise of the "Hyæna" on May 25th near Puffin Island.

Sertularia filicula, Ellis and Solander.

Recorded by Byerley as being "a general but not a very abundant species." Mersey (J. S. Hicks).

Dredged in Hilbre Swash on June 20th, 1885, from a depth of ten fathoms.

Several small colonies were obtained from the Isle of Man. No gonothecæ were present.

Sertularia abietina, Linnaeus.

Recorded by Byerley as being common upon the coast. Mersey (J. S. Hicks). Common, dead (A. O. Walker).

One small colony was found at Penmaenmawr in July, 1885. Some large colonies were dredged off the south end of the Isle of Man in August, 1885. One of these colonies was much covered by specimens of *Crisia denticulata*. Dredged at Hilbre Swash on June 20th. Several large colonies were dredged from Welshman's Gut on June 20th. Dredged off the Great Ormes Head on May 23rd, during the cruise of the "Hyæna."

Sertularia argentea, Ellis and Solander.

Recorded by Byerley as being very common. Mersey

* *British Zoophytes*, 1885.

(J. S. Hicks). Very common (A. O. Walker). Menai Straits (Pennington).

Several *very* small pieces were obtained from the Isle of Man in August, 1885. A great many large colonies with gonothecæ were dredged from Hilbre Swash on May 9th, 1885. Also a large amount was dredged from Welshman's Gut on June 20th, 1885, with gonothecæ.

Sertularia cupressina, Linnaeus.

Recorded by Byerley as being not quite so common as *S. argentea*. Mersey (J. S. Hicks). Common (A. O. Walker).

Several large colonies were dredged from the Welshman's Gut, June 20th, 1885, with gonothecæ. Also large colonies were obtained in Hilbre Swash, on May 9th, 1885, with gonothecæ.

Hydrallmania falcata, Linnaeus.

Recorded by Byerley under the name of *Plumularia falcata*, as being frequent in pools at low water. Mersey (J. S. Hicks). Very common, dead (A. O. Walker).

One small colony was obtained from Penmaenmawr, in July, 1885. A young colony was dredged off Port St Mary, on August 3rd, 1885. A great number of very large colonies were dredged from Hilbre Swash, on May 9th and June 20th, 1885. Also large colonies, with gonothecæ, were found in Welshman's Gut, on June 20th, 1885. On all of these occasions, large masses were brought up in the dredge, along with other zoophytes. Also obtained attached to *Buccinum*, *Fusus*, and *Natica*, on May 23rd, during the cruise of the "Hyæna."

Thuiaria articulata, Pallas.

Recorded by Byerley as being found at Hilbre, New Brighton, and elsewhere. Mersey (J. S. Hicks).

This species has not been found during our investigations.

Family IX.—Plumulariidæ.

Antennularia antennina, Linnaeus.

Recorded by Byerley as being picked up frequently with out polyps. Mersey (J. S. Hicks). Not uncommon (A. O Walker).

Several very large colonies, from three to ten inches in height, with gonothecæ, were obtained from the south end of the Isle of Man in August, 1885.

Obtained in Hilbre Swash on June 20th.

Antennularia ramosa, Lamarck.

Recorded by Byerley as being about as common as the preceding species. Mersey (J. S. Hicks).

A small piece, very much broken, showing neither gonothecæ nor nematophores, was dredged from the Welshman's Gut on June 20th, 1885.

Aglaophenia pluma, Linnaeus.

Plumularia cristata, Johnston, *B. Z.* 92, pl. xxiii, figs. 1–3. pl. xxiv, fig. 1.

Recorded by Byerley under the name of *Plumularia cristata* as having been found on the Bootle coast by Mr. Tudor. Rare, and frequently with polyps alive, parasitic on *Halidrys siliquosa*, Mr. Marrat. Mersey (J. S. Hicks). Also mentioned by Hincks as being common at the Isle of Man. Menai Straits (Pennington). Colwyn Bay (A. O. Walker).

Found at Penmaenmawr in July, 1885, by Mr. Thompson.

Aglaophenia myriophyllum, Linnaeus.

Plumularia myriophyllum, Johnston, *B. Z.* 99, pl. xxiii, figs. 4, 5.
Lytocarpus myriophyllum, Pennington, *Brit. Zooph.*

Recorded by Byerley under the name of *Plumularia myriophyllum* as being very rare; found once by Mr. Marrat at Waterloo, and once between Egremont and Seacombe. Mersey (J. S. Hicks). Isle of Man (Forbes).

Plumularia pinnata, Linnæus.

Several very large colonies, from three to four inches in height, all shewing gonothecæ well, were dredged at the Isle of Man during August, 1885.

One colony, shewing gonothecæ on the pinnæ, as well as in double rows on the stem, was dredged off Port Erin, Isle of Man, from a depth of fifteen fathoms.

Plumularia setacea, Ellis.

Recorded by Byerley as having been found at Bootle and New Brighton. Not common. Mersey (J. S. Hicks).

Plumularia catharina, Johnston.

Common at the Isle of Man (Hincks).

Plumularia similis, Hincks.

Mentioned by Hincks as being common at the Isle of Man.

LIST of the MEDUSÆ and CTENOPHORA of the L. M. B. C. DISTRICT.

By J. A. Clubb,

ASSISTANT IN THE ZOOLOGICAL LABORATORY, UNIVERSITY COLLEGE, LIVERPOOL.

The Medusoid Gonophores enumerated below were all, with the exception of *Thaumantias convexa*, and the species recorded by Mr. Byerley, collected by Professor Herdman off the south end of the Isle of Man, during July and August, 1885. *Thaumantias convexa* was taken by Mr. I. C. Thompson off Penmaenmawr, in July. The true Medusæ and the Ctenophora were obtained at the mouth of the Mersey.

The method of preservation adopted in the case of the Isle of Man specimens was as follows:—The tow-net was inverted in a large jar, containing about a gallon of salt water, to which about five or six grains of picric acid was added. The Medusoid Gonophores, and other organisms, which settled in a layer at the bottom of the jar, were shortly afterwards removed from the solution, and placed in weak alcohol. In the case of many of the Medusoid Gonophores so treated, there was found to be considerable contraction, especially of the tentacles, and the colour was always obliterated by the yellow staining due to the picric acid. Hence there is considerable difficulty in identifying them, and, in a few cases, the specimens are in such a condition that the species cannot be satisfactorily determined.

The specimens have been examined and identified in the Laboratory, under the direction of Professor Herdman; and I have followed the nomenclature given by Professor Edward Forbes in his "Monograph of the British Naked-eyed Medusæ," Ray Society, 1848.

Of the four species of Medusoid Gonophores recorded by Byerley, in 1853, not one has been found by the L. M. B. C.; and of the four species of the true Medusæ, recorded from the neighbourhood by Byerley, only the two commoner species were obtained during last Summer's investigations.

HYDROMEDUSÆ.*

Order.—HYDROIDA.

Family.—Clavidæ.

Turris neglecta, Lesson.

"Taken rarely in the Mersey, by Mr. Price" (Byerley).

Family.—Corynidæ.

Sarsia tubulosa, Sars.

"Caught in the Mersey. Rare. Mr. Price" (Byerley).

Family.—Atractylidæ.

Bougainvillia britannica, Forbes.

Several specimens of this species were taken on August 1st (mid-day); on August 21st; and one specimen on August 22nd (noon, stiff breeze), off Port Erin, Isle of Man. The specimens were all small. This species is new to the locality.

Family.—Companulariidæ.

Thaumantias pilosella, Forbes.

Found abundantly by Mr. Garner,† in Douglas Bay.

Thaumantias octona, Forbes.

This species is fairly common off Port Erin, Isle of Man. Specimens were obtained on August 19th, 21st, and 22nd.

Some of the specimens differ from Forbes' description in having the tentacles much shorter and thicker, and the tentacle-bulbs larger. Also, in one or two specimens, I could

* For the Hydroid forms of the Hydromedusæ, see *Report on the Hydroida*, p. 95.

† *Holiday Excursions of a Naturalist*, p. 82. 1867.

only make out one colourless tubercle between the tentacles, whereas Forbes describes two. This species is new to the locality.

Thaumantias convexa, Forbes.

Found by Mr. I. C. Thompson, off Penmaenmawr, in July, 1885. This species is new to the locality.

Thaumantias thompsoni, Forbes.

This species was obtained in fairly large numbers, on four different occasions, off Port Erin, Isle of Man, viz., on August 1st, 19th, 21st, and 22nd.

The specimens are generally small and contracted, the breadth of the umbrella varying, after preservation in picric acid and alcohol, from about $\frac{1}{16}$ inch to $\frac{1}{8}$ inch; while Forbes describes it as being, when living, and full-grown, about $\frac{1}{4}$ inch across the umbrella. This species is new to the locality.

Thaumantias hemisphærica, Müller.

This species was obtained in great profusion on August 21st, from the sheltered harbour of Port Erin, Isle of Man, inside the Breakwater. I may here remark that the surface material of August 21st was the most fruitful in Medusoid Gonophores, four species in all being obtained; thus bearing out Forbes' statement, that "they (Medusoid Gonophores), abound most in sheltered bays." This species was also obtained on the following day, August 22nd, but in much smaller numbers. The specimens varied very much in size, and the adult formula of Forbes for the tentacles ($7 \times 4 + 4$) was by no means constant. This species is new to the locality.

Thaumantias lucida, Forbes.

Medusa hemisphærica, var. *lucida*, Macartney, *Phil. Trans.* (1810).

Two small specimens only of this species occurred on

August 1st, off Port Erin, Isle of Man. This species is new to the locality.

Thaumantias punctata, Forbes.

"Rare in the Mersey" (Byerley). This species was obtained off the Isle of Man, in June, 1839, by Professor Forbes (*British Naked-Eyed Medusæ*, p. 53).

Family.—LEPTOSCYPHIDÆ.

Lizzia octopunctata, Sars.

"Taken by Mr. Price, in the River Mersey." (Byerley).

Order.—ACALEPHA.

Sub-order.—DISCOPHORA.

Family.—AURELIDÆ.

Aurelia aurita, Linn.

"Mr. Price, who has paid great attention to this beautiful tribe of animals, finds this species most abundantly about the month of May every year" (Byerley). It was obtained by members of the L. M. B. C., during last summer, stranded on the shore at New Brighton.

Family.—PELAGIDÆ.

Chrysaora hyoscella, Esch.

"Rare. Seen mostly during the months of July and August" (Byerley). This species has not yet been obtained by the L. M. B. C.; but Mr. Walker informs me that it is frequently very common all along the coast.

Family.—CYANEIDÆ.

Cyanæa capillata, Esch.

"A very common species. Appears on our shores from July to October. Mr. Price has observed a yellow Medusa, very like this species, during the May month" (Byerley).

This species has been obtained by the L. M. B. C., stranded on the shore at New Brighton.

Family.—RHIZOSTOMIDÆ.

Rhizostoma pulmo, Linn.

"This large species may be considered rare in the district. Mr. Price informs me that he has commonly observed about three or four in a year. Mostly seen in the month of September, and later in the year" (Byerley). This species has not been found during the last year; but Mr. Walker states that it is sometimes very common, and that he has often seen many hundreds in a day.

[None of the SIPHONOPHORA belong properly to the Liverpool Bay Fauna, but Mr. T. J. Moore informs me that numerous specimens of *Physalia pelagica* were found cast ashore at Southport, after strong westerly gales, at the end of Feb., 1860, and several examples were obtained for the Liverpool Museum.]

CTENOPHORA.

Order.—SACCATA.

Family.—CYDIPPIDÆ.

Pleurobrachia pileus, Flem.

This species appeared in great profusion in the neighbourhood of Hilbre Island, towards the end of May, 1885. A few specimens were also obtained by Professor Herdman off the south coast of the Isle of Man, during the month of August, in the same year.

Byerley records it as being "found mostly early in April, but also, more sparingly, at other times." Mr. Price* records it as being very plentiful at Woodside Slip, in 1834.

* *Old Price's Remains*, Liverpool.

Pleurobrachia pomiformis.

"Very rare" (Byerley). Has not yet been obtained by the L. M. B. C.

Order.—EURYSTOMATA.

Family.—Beroidæ.

Beroe ovatus, Lam.

"Irregular in the time of its appearance, but sometimes as early as *Cydippe pileus*" (Byerley). Has not yet been obtained by the L. M. B. C.

Order.—LOBATA.

Family.—Mnemiidæ.

Bolina hibernica.

This species (= *Alcinoë vermiformis*, Cuvier) has been found twice by Mr. Price at Birkenhead.

REPORT on the ALCYONARIA of the L. M. B. C. DISTRICT.

By Professor Herdman, D.Sc.

Only two species belonging to the Alcyonaria—the common *Alcyonium digitatum* and the rare *Sarcodictyon catenata*—can be recorded here. None of the British Pennatulida, although they all occur on the West Coast of Scotland, have yet been found in this neighbourhood.

ALCYONARIA.

ALCYONIDA.

Family I.—Cornularidæ.

Sarcodictyon catenata, Forbes (Pl. II, figs. 1 and 2).

Several colonies of this rare species were dredged in August, 1885, between Port St. Mary and Spanish Head, Isle of Man, from a depth of twenty fathoms; bottom, Nullipores. They all belong to the red variety, and one of them shows that widening of the stolon in places to form expansions upon which the polypes are grouped in twos and threes, which Forbes supposed to be characteristic of his *Sarcodictyon agglomeratum*.* The colonies vary in size from three to nearly thirty polypes. They agree in all respects with the Scotch specimens described in my paper on *Sarcodictyon* referred to below.

In specimens of *Sarcodictyon catenata*, dredged from Loch Fyne, I had never succeeded in inducing the polypes to expand in captivity, but in the case of a large colony obtained in Lamlash Bay, in the autumn of 1884, and again

* See Forbes, *Trans. Roy. Soc.*, Edin., vol. xx, p. 307, 1853; and Herdman, *Proc. R. Phys. Soc.*, Edin., vol. viii, p. 31, 1883.

in the colonies dredged off the Manx coast, after being kept in an aquarium for a few days, the polypes expanded fully, and then presented the appearance shewn in Pl. II, figs. 1 and 2. Figure 1 represents the colony, about natural size, and figure 2 one of the polypes enlarged. These shew that the polype may expand to over three times its normal height, the clear upper part of the body being about twice the length of the opaque lower part. This expanded upper part of the body is of a translucent white colour. The tentacles are exceedingly slender and graceful, and may be extended to a great length; they are usually as long as the entire body of the polype. They are very delicate, and have an entirely different shape from that which they present when dead and preserved in alcohol.* The stomodæum is usually distinctly visible in the expanded polype (see Pl. II, fig. 2) as a less translucent white band running from the mouth downwards to the opaque red lower part of the body.

The colonies which expanded in captivity were very sluggish in their movements, and slow in responding to stimulation. The specimens were dredged and placed in the small aquarium on August 7th, and it was not until August 12th that the first polype of the first colony elongated its body and expanded its tentacles. On the following day (Aug. 13th), the whole colony of fifteen polypes was in a completely expanded condition (see Pl. II, fig. 1). But when once expanded the polypes remained so, with very slight movement of any kind, and it was not very easy to induce them to retract the tentacles—agitation of the water surrounding them, and even shaking of the stone to which they were attached, seemed to have no effect whatever. When the tentacles were pricked with the point of a needle they slowly retracted, and if the irritation was continued the upper part of the body wall was slowly and gradually drawn inwards

* Herdman, *loc. cit.*, see pl. i, figs. 8, 9, 10.

until the polype was completely retracted. But the neighbouring polypes of the same colony were not affected in the least degree; they remained in a fully expanded condition. On the following day (Aug. 14th), the polypes were all retracted, and they remained in that condition until August 18th, when a few of them again became elongated and showed their tentacles. On the next day again, most of the colony was fully expanded for a short time, and then all the polypes retracted until August 21st, when a few of them again expanded for the last time. On this day, the second colony in the aquarium expanded for the first time, exactly a fortnight after it was dredged. Some of the polypes of this second colony expanded again on August 23rd, and a few days later, both colonies were placed in alcohol.

Family II.—Alcyonidæ.

Alcyonium digitatum, Linn.

This species is fairly abundant at Hilbre Island at low water mark, attached to the rocks. Byerley records it also from New Brighton and shore-pools at Egremont, where, however, the specimens were much smaller. There are probably none at all in these latter localities now. Both the common varieties, the deep orange and the pure white, are found at Hilbre. As in the case of *Sarcodictyon catenata*, the difference in colour is entirely due to the spicules.

This species was also dredged between Port St. Mary and the Calf, Isle of Man, from a depth of fifteen fathoms, during August; and it was obtained on the "Spindrift" Expedition, off Point of Ayr; and in Hilbre Swash, on several occasions, from depths of nine to eleven fathoms. During the cruise of the "Hyæna," it was dredged to the north of Puffin Island, from a depth of fourteen fathoms.

REPORT on the ACTINIARIA of the L. M. B. C. DISTRICT.

By John W. Ellis, L.R.C.P., F.E.S.

The classification and nomenclature of species given by Dr. Andres * in his recent monograph on the Actiniæ of the Bay of Naples have been followed in this Report, but the old and well-known names used by Gosse † and other writers on British Anemones have been inserted, when required, as synonyms.

ACTINIARIA.

Family.—Actinidæ.

Sub-family.—Halcampinæ.

Halcampa chrysanthellum, Peach (?).

A single specimen of a species, which from the presence of twelve tentacles only would seem to be correctly placed in this genus, was dredged from a depth of ten to twenty fathoms off the S.E. coast of the Isle of Man, by Professor Herdman, in August, 1885, but from its contracted state and loss of colour, the specimen is not capable of being identified. Very probably it is *Halcampa chrysanthellum*, which according to Professor Haddon, is a very variable species, and is found on the Irish coast, near Dublin.

Sub-family.—Sagartinæ.

Actinoloba dianthus, Ellis (1767).

This species, the Plumose anemone, is probably one of the most common anemones in the immediate vicinity of Liverpool.

* *Fauna und Flora des Golfes von Neapel. IX Monographia. Die Actinien. Leipzig*, 1884.

† *Actinologia Britannica, London*, 1860.

It is recorded by Byerley as being found at "Hilbre Island at low ebbs; some specimens pure white, and others of a deep buff colour. The white variety is plentiful on the Dingle shore."

Mr. Wood, the attendant in the aquarium at the Derby Museum, Liverpool, informs me that the species still occurs on the pontoons of the Liverpool landing-stage, the locality recorded by Gosse in *Actinologia Britannica*. Fine specimens are frequently procured by him for the tanks at the museum at extreme low water-mark on the Leasowe shore, opposite the embankment, on a gravelly and stony bottom, the handsome semi-translucent white specimens (var. *sidonea*, Gosse) being the most plentiful. In one of the tanks at the museum there are now (December, 1885) two beautiful specimens, found by him in this locality, with the column of a rich purple-brown and the tentacles pure white; evidently a form of the variety *brunnea*, Gosse.

A few large specimens, all of the white variety, have been dredged during the expeditions of the Marine Biology Committee; and in one of the shore excursions to Hilbre Island, a large number of the flesh-coloured variety (*rubida*, Gosse), all, however, very young, were found studding an overhanging detached piece of rock at the extreme north end of the island. Professor Herdman found small specimens of this form at the south end of the Isle of Man in August last. Mr. Gosse (*Actinologia Britannica*) records this species from Morecambe Bay, his authority being Mr. F. H. West. Mr. A. O. Walker has taken the variety *sidonea* in Colwyn Bay; and Mr. J. Chard has taken the species at Moelfra Bay, Anglesea.

Heliactis bellis, Ellis and Solander (1786).

Sagartia bellis, Gosse and other authors.

Recorded from Puffin Island and from the Isle of Man, by Gosse, in *Actinologia Britannica*. We have no record of its occurrence in the immediate vicinity of Liverpool.

Heliactis miniata, Gosse (1853).

Sagartia miniata, Gosse and others.

The Menai Straits and Hilbre Island are given by Gosse as localities for this species, but no specimens have been found there by members of the Committee.

Heliactis venusta, Gosse (1854).

Sagartia venusta, Gosse.

This species was obtained in the vicinity of the Calf of Man, by Professor Herdman, in August last. It is also recorded from Puffin Island by Gosse, on the authority of Mr. E. L. Williams.

Cylista viduata, Müller (1776).

Sagartia viduata, Gosse.

This is a species which is recorded by Gosse as abundant in the Menai Straits, and also as occurring at Puffin Island, and at the mouth of the River Dee, but which, so far as can be ascertained, has not been procured during the expeditions of the Marine Biology Committee. It was found at Beaumaris on August 13th, 1881, by Mr. A. O. Walker.

Cylista undata, Müller (1788).

Sagartia troglodytes, Johnston (1847).

Recorded by Gosse as occurring in the Menai Straits and the estuary of the Mersey, and at Birkenhead, Hilbre Island, Morecambe Bay, and the Isle of Man. Recorded by Byerley as having been found upon the Leasowe Shore and near Egremont Slip. Mr. Byerley (*Fauna*, p. 106), gives an account of the habits of this species in captivity.

This species was found very abundantly during one of the shore expeditions of the Marine Biology Committee to Hilbre Island, but out of a very large number of individuals collected and observed, very few differed from the type form as described by Gosse (var. *scolopacina*). Several specimens were noticed

with orange tentacles surrounding a dull blue disc, but these were so injured by the attempt to detach them that they died without expanding, and whether these belonged to the variety *nobilis*, Gosse, first brought under his notice by the Honourable Lady Cust, will remain for future observations to verify. This variety was found by Mr. Walker at Llandrillo, in 1879.

Among the specimens brought home by myself on this occasion (July 11th, 1885), was one which I was quite unable, after repeated endeavours, to identify with any of the varieties of this most protean species described by Gosse. This form is so very distinct that I have ventured to append a description and a figure of it, and since it possesses a disc of the purest white, I propose the name of var. *candida* for it. The following is a description taken from the specimen during life.

Cylista undata, Müll., var. *candida*, nov. (see Pl. II, figs. 3 and 4).

Column.—Capable of great elongation, pale drab, with darker longitudinal lines at the base, disappearing at about half the height.

Disc.—Pure opaque white, the radii not indicated; the extreme margin of the disc is translucent deep purple.

Mouth.—Concolorous with the disc, slightly elevated on a cone.

Tentacles.—Not very numerous, in about five rows, the inner ones being longest. All are pellucid grey, tipped with opaque white; the inner row, six in number, have a dark purple longitudinal stripe on the face and back; the remainder have similar stripes of scarlet, the whole of the base of the tentacle being suffused with the same colour as the stripe. Near the foot of the inner tentacles only, is a faintly indicated dark cloud representing the B mark of the typical form of this species.

Habitat.—Hilbre Island, at the extreme north extremity, near low-water mark.

The varieties of *Cylista undata* recorded by Mr. P. H. Gosse as inhabitants of our district, principally on the authority of Mr. F. H. West, are as follows:—

Var.	*hypoxantha*	Morecambe Bay.
,,	*badifrons*	do.
,,	*albicornis*	do.
,,	*nigrifrons*	do.
,,	*fulvicornis*	do.
,,	*pallidicornis*	do.
,,	*melanoleuca*	do.
,,	*auricoma*	do.
,,	*luna*	do.
,,	*nox*	do.
,,	*eclipsis*	do.
,,	*nycthamera*	do.
,,	*nobilis*	Cheshire coast.

Adamsia palliata, Bohadsch (1761).

Recorded from the Isle of Man, by Gosse.

Several specimens were dredged off Spanish Head, between Port St. Mary and the Calf, Isle of Man, from a depth of twenty fathoms, by Professor Herdman, these being, as usual with this species, attached to shells inhabited by the hermit-crab, *Pagurus prideauxii*.

Sagartia sphyrodeta, Gosse (1858).

Recorded (Gosse's *Actinologia Britannica*) from Hilbre Island, on the authority of Mr. E. L. Williams.

Sub-family.—Actininæ.

Actinia equina, Linné (1766 to 1768).

Actinia mesembryanthemum, Ellis and Solander (1786).

This species, in most localities the commonest anemone,

is not at all common in the district investigated by the Marine Biology Committee. It has only been taken by members of the Committee on the Manx coast. The fact of its absence from the Mersey district is thus noted by Gosse * :—

"It is a curious fact, for which I am indebted to Mr. E. M. Williams, Jun., that 'the Mersey estuary is the only place on the coasts where he has not found this species,' which he attributes to the foulness of the water. This absence would be less remarkable were it not that *Tealia crassicornis* is abundant there; but *Actinia* is clean and *Tealia* is dirty in its habits. In the neighbouring estuary of the Dee the former is common as usual."

Byerley, in his *Fauna*, remarks:—"Mr. Price states that he met once with this species upon our shore. I have a specimen now (1855) alive, which I took at Hilbre; rare on this coast until this year, when several have been taken." It has not been found at Hilbre Island on any of the expeditions of the Liverpool Marine Biology Committee during 1885. The species is common at the south end of the Isle of Man, and also at Colwyn Bay.

Anemonia sulcata, Pennant (1766).

Anthea cereus, Auct.

This species has been obtained by one of the members of the Committee, at Douglas, Isle of Man, the only locality in our district recorded for this species by Gosse, but the contracted and bleached state of the specimens prevents any differentiation of varieties. It was also obtained in rock pools on the shore at Port Erin, Isle of Man.

Sub-family.—Bunodinæ.

Tealia crassicornis, Müll. (1776).

This is probably the species referred to as *Actinia coriacea* by Byerley. It is abundant throughout the dis-

* *Actinologia Britannica.*

trict, but it has nearly disappeared from one locality where it used to be common, viz., below the New Brighton lighthouse. Most of the specimens seem to belong to the ordinary type form, but Professor Herdman noticed specimens at the Isle of Man which answer to the descriptions of the varieties *insignis* and *purpurea* of Gosse, while one of the latter form is now in one of the tanks at the Liverpool Museum.

Mr. Price recorded the species from New Brighton thirty years ago. It was then very abundant.

Bunodes gemmaceus, Ellis and Solander (1786).

Recorded by Gosse, from Douglas, Isle of Man.

Professor Herdman obtained a number of specimens of this species at Port Erin. The medium-sized specimens shew best the characteristic variation in the size and colour of the warts.

Family.—Stichodactylidæ.

Sub-family.—Corynactinæ.

Corynactis viridis, Allman (1846).

This species, which is recorded from the Irish coast by Gosse, was obtained by Professor Herdman, by dredging in deep water off Spanish Head, at the south extremity of the Isle of Man, in August last. From descriptions given to me of the appearance of the specimens during life, I believe these to be of the variety *rhodoprasina*, Gosse.

Capnea sanguinea, Forbes (1841).

Obtained by Professor Forbes, "in deep water off the Isle of Man, on Nullipore beds." Since, with the exception of Falmouth, this is the only locality recorded for this beautiful species, it is very desirable that it should be specially looked for in any future dredgings off the Manx coast.

Family.—ZOANTHIDÆ.

Sub-family.—ZOANTHINÆ.

Polythoa arenacea, Delle Chiaje (1836).

Zoanthus couchii, Johnston (1838).

Several examples of this species, which is not recorded by Gosse from any locality nearer to us than the Irish coast, were obtained by Professor Herdman, along with *Corynactis viridis*, off Spanish Head, at the south end of the Isle of Man, from a depth of twenty fathoms. This is therefore a new locality for both these species. The specimens are adherent to fragments of a Nullipore.

Family.—CERIANTHIDÆ.

Sub-family.—CERIANTHINÆ.

Cerianthus lloydii, Gosse (1859).

So named by Mr. Gosse from its discoverer, Mr. Alfred Lloyd, who found it in the Menai Straits, in July, 1856. This species also deserves to be specially looked for in future expeditions.

Of the twenty species of Actiniaria recorded by Gosse as inhabiting the Irish Sea (for one of which, however, *Sagartia nivea*, he gives no Irish Sea locality), seventeen are known to inhabit the Liverpool Bay district, and of these eleven have been collected by members of the Committee.

Only four distinct species (*Actinia equina*, *Cylista undata*, *Tealia crassicornis*, and *Actinoloba dianthus*) are recorded in Byerley's list. They were all obtained in the immediate neighbourhood of Liverpool.

REPORT upon the CRINOIDEA, ASTEROIDEA, ECHINOIDEA, and HOLOTHUROIDEA of the L. M. B. C. DISTRICT.

By W. A. Herdman, D.Sc.,
PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL.

This Report deals with all the groups of the Echinodermata with the exception of the Ophiuroidea, which are discussed in a separate paper by Mr. H. C. Chadwick (see p. 140). Most of the species were obtained off the southern end of the Isle of Man, where there is a rich and varied Echinoderm fauna. In the immediate neighbourhood of Liverpool comparatively few species were obtained, although some of them exist in great profusion (*e.g.*, *Asterias rubens* at Hilbre Island). The numbers of species to be recorded in the different Echinoderm groups are as follows :—Crinoidea, 1 ; Asteroidea, 11 ; Echinoidea, 6 ; Holothuroidea, 5. Mr. Chadwick (p. 140) discusses six species of Ophiuroidea, making in all twenty-nine Echinodermata.

For previous records of occurrence I have made use of Mr. Byerley's *Fauna*, Forbes' *British Star Fishes*, *The British Association Report upon Marine Zoology*, and a List compiled by the Isle of Man Natural History Society, in 1884. I have to thank my friend, Professor Jeffrey Bell, for assistance in regard to the nomenclature and synonymy of some of the species.

CRINOIDEA.

Family.—Comatulidæ.

Antedon rosaceus, Link.

Comatula rosacea, Link. Forbes, *British Star Fishes*, p. 5.

This species occurs in deep water around the shores of

the Isle of Man. It has been dredged by Mr. R. Garner off Douglas Bay, and near Port Erin and The Calf. It is also recorded by Forbes (*Brit. Assoc. Rep.*, 1850), as having been taken off the Isle of Man in twenty-five fathoms.

It occurred in abundance in depths of from ten to twenty fathoms off Port Erin, Port St. Mary, and Spanish Head, at the southern end of the Isle of Man, last summer. The specimens were of fair size, and shewed the usual variations in colour; yellow, tawny, orange, and crimson individuals being obtained.

Some of the specimens of *Antedon* were infested with the interesting little ectoparasite, *Myzostoma*.

The Pentacrinoid larvæ of *Antedon* were obtained during the last week of July and first fortnight of August, attached to seaweeds, from a depth of ten to twenty fathoms, off Port Erin, Isle of Man.

ASTEROIDEA.

Family.—ASTERIADÆ.

Asterias rubens, Linn.

This species, the *Uraster rubens* of Forbes' *British Star Fishes*, and of Byerley's *Fauna*, is exceedingly abundant on the rocks at the north end of Hilbre Island, between tide marks. In some places the star fishes are so closely placed as to almost entirely cover the rocks for some yards. They seem to have been increasing in numbers at Hilbre Island of late years, and possibly they may be driving away or exterminating some of the other animals of the littoral zone.

The common star fish is also found in this neighbourhood by dredging. It was obtained in abundance, and of large size, in Hilbre Swash, during the "Merry Andrew" and "Spindrift" expeditions, and was dredged, during the cruise of the "Hyæna," off the Great Ormes Head, depth seven to eight fathoms, on May 23rd, 1885.

It is plentiful around the south coast of the Isle of Man, and also in the neighbourhood of Penmaenmawr, and at Fleetwood.

Asterias glacialis, Linn.

This large species, the *Uraster glacialis* of Forbes and other authors, has been taken in deep water off the Manx coast (Wallace, recorded by Forbes), and has also been found at Port Erin and the Calf of Man, by Mr. Garner.* It has apparently not been found nearer Liverpool. The species is not uncommon further up the west coast. I have dredged it in Lamlash Bay,† Arran, and at the entrance to Loch Fyne, and in the Sound of Mull.

Asterias hispida, Pennant.

Uraster hispida, Penn. Forbes, *British Star Fishes*, p. 95.

I have referred to this species a small star fish with short and rather rounded rays, which was obtained during the cruise of the "Hyæna," on May 24th, 1885, in the entrance to the Menai Straits, near Bangor. The specimen measures 2·5 cm. in diameter, and seems to agree with the description and figure given by Forbes.

This species was originally found by Pennant in Anglesea, and Dr. Coldstream came upon it on the limestone rocks, near Castletown, Isle of Man.

Family.—SOLASTERIDÆ.

Cribrella sanguinolenta, Sars.

Cribella oculata, Penn. Forbes, *British Star Fishes*, p. 100.

Several specimens of this species were dredged off Port Erin, and between Port St. Mary and The Calf, Isle of Man, during August, 1885. It has not been recorded from the

* *The Holiday Excursions of a Naturalist*, by R. Garner, 1867.

† "Notes on the Fauna of Lamlash Bay." *Proc. Roy. Phys. Society*, Edin., vol. v, p. 193, 1880.

immediate neighbourhood of Liverpool, and does not occur in the list of Echinodermata drawn up by the Isle of Man Natural History and Antiquarian Society* in 1884. It was found, however, by Pennant, on the shores of Anglesea; and Forbes, in his *British Association Report*,† records having dredged the species both off the Isle of Man and off the North Wales coast, from depths of twenty to twenty-five fathoms. Mr. A. O. Walker informs me that he has found it on the shore at Colwyn Bay.

The Manx specimens which we have found are rather small, and have the rays relatively narrower, and the upper surface less spinose, than is usual in the species.

Solaster endeca, Linn.

Forbes (*Brit. Star Fishes*, p. 111) records this species as being not rare in deep water off the Isle of Man. We have not found it.

Solaster papposa, Linn.

This common species, the sun-star, is recorded by Byerley as being not uncommon at Hilbre Island, Caldy Blacks, New Brighton, &c. Forbes dredged it in deep water around the Isle of Man, and also off the North Wales coast.

This species was obtained frequently, during last August, off the southern end of the Isle of Man. It was also obtained during the cruise of the "Hyæna," off the Great Ormes Head, depth seven to eight fathoms, on May 23rd; and north of Puffin Island, depth eleven to thirteen fathoms, on May 24th. It has been found on shingle at low water at Blackpool.

Family.—ASTERINIDÆ.

Asterina gibbosa, Pennant.

This small species was obtained in abundance during

* For a copy of this paper I am indebted to the President of the Society, Mr. P. M. C. Kermode, of Ramsey.

† "Report on British Marine Zoology," Part I, *British Association Report*, 1850, p. 211.

July and August, 1885, at various points on the eastern, southern, and western shores of the Isle of Man. It was found at Bay-ny-Carrickey, near Poyllvaaish, Port St. Mary, Port Erin, Fleshwick Bay, etc., always in tidal pools, and usually attached to *Corallina officinalis*.

Prof. Forbes and Dr. Coldstream found the species in tidal pools at Castletown, Isle of Man, and Mr. R. Garner obtained it from pools amongst the rocks, north-west of the Stack.

The specimens which I have collected vary in extreme diameter from 2·5 mm. to 2·8 cm. They were, when living, nearly all of a dull greenish colour, although a few yellowish and reddish specimens also occurred. The specimens from Port St. Mary and the neighbourhood were much larger than those from Port Erin.

Palmipes membranaceus, Retz.

"This species is by no means uncommon in deep water off the coast of the Isle of Man, where I have dredged many specimens." (Forbes, *Brit. Star Fishes.*)

Porania pulvillus, Gray.

Goniaster templetoni, Forbes, *Wern. Mem.*, and *Brit. Star Fishes*, p. 122.

Recorded by Forbes from deep water, off the Isle of Man; and by Garner from near The Calf.

Family.—ASTROPECTINIDÆ.

Astropecten irregularis, Penn.

Asterias aurantiaca, Linn. Forbes, *Brit. Star Fishes*, p. 130.

This species is recorded by Forbes from the Manx coast, and from the coast of North Wales. It is often found cast ashore by storms at Penmaenmawr (Darbishire); and has been found at Formby Point (G. H. Morton).

A very fine specimen, with the Annelid *Malmgrenia*

castanea stretched along one of the ambulacral grooves, was dredged during the cruise of the "Hyæna," from a depth of fourteen fathoms, at about six miles north of the Great Ormes Head.

Luidea savignii, Audouin.

Luidea fragillissima, Forbes, *Brit. Star Fishes*, p. 135.

Prof. Forbes states that he has taken this species several times on the Manx coast—always with seven rays.

ECHINOIDEA.

Order I.—DESMOSTICHA.

Family.—Echinidæ.

Echinus esculentus, Linn.

This common species, the *Echinus sphæra* of Forbes' *British Star Fishes*, and other works, is common off the south end of the Isle of Man. It was taken frequently last summer in the neighbourhood of Port Erin, and some very large specimens occurred. In one case the Annelid *Hermadion assimile* was found coiled around the edge of the peristome of the *Echinus*.

One or two specimens have been found, cast ashore near Liverpool, by Mr. Marrat (Byerley); and it was obtained at low tide at Hilbre Island, on June 13th, 1885.

Forbes (*Brit. Assoc. Rep.*) records this species from the Isle of Man, but not from the shores of North Wales. It was obtained during the cruise of the "Hyæna," between Puffin Island and Anglesea, on May 25th, 1885, and was taken by Mr. Thompson in the neighbourhood of Penmaenmawr.

Echinus miliaris, O. F. Müller.

This species is recorded by Mr. Byerley as having been taken sparingly in the dredge at the entrance of the Dee; and by Prof. Forbes from the Isle of Man, and from the coast of North Wales.

It was obtained during the cruise of the "Hyæna" near Puffin Island, on May 24th; and was taken frequently in the neighbourhood of Port Erin and Port St. Mary, at the south end of the Isle of Man, last summer. The largest specimens measure from 1 cm, to 1·5 cm. in diameter (exclusive of spines). It was also obtained in the neighbourhood of Penmaenmawr in July.

Order II.—CLYPEASTRIDA.

Family.—Euclypeastridæ.

Echinocyamus pusillus, Gray.

This little species is not uncommon in this locality. Byerley records having taken several specimens by dredging; and Forbes (*Brit. Assoc. Rep.*) has found it both at the Isle of Man and also on the North Wales coast. It was obtained by the Marine Biology Committee, at the following places in the district during last year's investigations:—(1.) During the cruise of the "Hyæna," on May 23rd, off the Great Ormes Head, depth seven to eight fathoms. (2.) Off the south end of the Isle of Man, near Port Erin, ten to twenty fathoms, and off Spanish Head, fifteen fathoms, bottom Nullipores. (3.) At Hilbre Island, at low tide, on June 13th, 1885.

Some dead tests of this species were found worked into the sandy investments of *Molgula occulta*, dredged off Port Erin, Isle of Man.

Order III.—PETALOSTICHA.

Family—Spatangidæ.

Spatangus purpureus, Müller.

Forbes (*Brit. Star Fishes*, p. 182) records this species as being abundant on the scallop-banks, off the Isle of Man. He has also found it off the coast of North Wales, at a depth of

twelve fathoms. It is found living of large size at low water in muddy gravel near Beaumaris (Darbishire).

One rather small specimen was dredged in August, off Port Erin, Isle of Man, from a depth of fifteen fathoms.

Echinocardium cordatum, Pennant.

Amphidotus cordatus, Penn. Forbes, *Brit. Star Fishes*, p. 190.

This species is common in the locality. Byerley records having dredged living specimens, and found dead shells cast ashore. It is very abundant at low water from Penmaenmawr to Southport.

It has been found by the Marine Biology Committee at various points on the coast.

Echinocardium flavescens, O. F. Müller.

Amphidotus roseus, Forbes, *Brit. Star Fishes*, p. 194.

This species was found by Forbes, in deep water, on the Manx coast, and also on the North Wales coast.

It was dredged last August off Port Erin, Isle of Man, from a depth of fifteen to twenty fathoms; and a number of small specimens, about 7 mm. in greatest length, probably belonging to this species, were dredged off Bradda Head, near Port Erin, from a depth of fifteen fathoms.

HOLOTHUROIDEA.

Order.—PEDATA.

Family.—DENDROCHIROTÆ.

Thyone papillosa, Müller.

Forbes dredged this species on the scallop-banks, off the Isle of Man, in 1838, and a single specimen was obtained in August, 1885, from a depth of fifteen fathoms, off Port Erin, Isle of Man.

Thyonidium drummondii, Thompson.

Cucumaria drummondii, Thompson.
Cucumaria communis, Forbes and Goodsir.
Thyone portlockii, Forbes.

Byerley states that a single specimen of *Cucumaria communis* was obtained by a fisherman at Hoylake. Probably it was the present species.

A large Holothurian which was found cast ashore alive on the north end of Hilbre Island by the Committee agrees closely with Forbes' description and figure of *Thyone portlockii*, which is identical with *Thyonidium drummondii*. It has also been found on the beach at Penmaenmawr.

Ocnus brunneus, Forbes.

= *Ocnus lacteus*, Forbes and Goodsir (?)

Forbes records this species from the Isle of Man, and a small specimen was dredged in August, 1885, from a depth of fifteen fathoms, off Spanish Head, Isle of Man.

Cucumaria pentactes, Müller.

This species is recorded by Forbes (*Brit. Assoc. Rep.*) from the Isle of Man, twenty fathoms.

A single specimen was obtained during the cruise of the "Hyæna," on May 24th, 1885, near Puffin Island, from a depth of fourteen fathoms.

Cucumaria hyndmanni, Thompson.

A single specimen of this species was dredged in August, 1885, from a depth of twenty fathoms, off Port Erin, Isle of Man,

REPORT on the OPHIUROIDEA of the L. M. B. C. DISTRICT.

By Herbert C. Chadwick.

The specimens of Ophiuridæ, or Brittle Stars, collected in the dredging expeditions of the Liverpool Marine Biology Committee, during the summer of the year 1885, and placed in my hands for examination, include examples of six well-known species, referable to five genera. None of the specimens present features of special interest.

OPHIUROIDEA.

Family.—Ophiuridæ.

Ophioglypha ciliata, Retzius (sp).

Asterias ciliata, Retzius, *Diss, sistens species cognitas Asteriarum*, p. 29, 1805.

Ophioglypha ciliata, Ljungman, Dr. Goës, *Oph. Öf. Kong. Akad.*, p. 651, 1871.

Ophiura texturata, [pars], Lamarck, *Hist. Anim. sans Vert.*, p. 542; Forbes, *Wern. Mem.*, vol. viii, p. 125, pl. 4, figs. 3, 4; *British Star Fishes*, p. 22.

Ophioglypha lacertosa, Lyman, *Ill. Cat. Mus. Comp. Zool.*, No. I, p. 40; Ludwig, *Echin. des Mittelmeeres*, p. 546.

Specimens of this species were dredged from a muddy bottom, at a depth of ten fathoms, in the Menai Straits, off Bangor, during the cruise of the "Hyæna." Associated with the next species it occurs in considerable numbers in that locality. It was also found off Port Erin during August. Mr. Byerley * records it as having been taken at

* Isaac Byerley "Fauna of Liverpool," *Proc. Lit. and Phil. Soc. of Liverpool*, 1853–4, No. VIII, Appendix.

Hilbre Island, and dredged at various points around the coast. It has been found at Formby Point by Mr. Morton.

Ophioglypha albida, Forbes (sp).

Ophiura albida, Forbes, *Wern. Trans.*, vol. viii, p. 125, pl. 4, figs. 5, 6; *British Star Fishes*, p. 27; Lutken, *Addit. ad Hist.*, part i, p. 39, pl. 1, figs. 2*a*, *b*.

Ophioglypha albida, Lyman, *Ill. Cat. Mus. Comp. Zool.*, No. I, p. 49, 1865; Ludwig, "Anatomie der Ophiuren," *Zeits. für Wissen. Zoologie*, vol. xxxi, p. 241; *Echin. des Mittelmeeres*, p. 547.

This species, associated with the foregoing, occurs in great numbers in the Menai Straits, where it was dredged during the cruise of the "Hyæna," on May 24th. It was also dredged in August, from a depth of twelve fathoms, off Port Erin, Isle of Man; bottom gravel and stones; and from depths varying from ten to twenty fathoms, off Spanish Head and Port St. Mary to The Calf, Isle of Man; bottom chiefly nullipore and gravel. Also obtained off Penmaenmawr. Byerley (*loc. cit.*) records it as occurring in deep water about the mouth of the Dee and north of Wirral.

Ophiopholis aculeata, Retzius (sp).

Asterias aculeata, Retzius, *Asteriæ Gen.*, p. 240, 1783.

Ophiopholis aculeata, Gray, *Rad. Animals Brit. Mus.*, p. 25, 1848; Lutken, *Addit. ad Hist.*, part i, p. 60, pl. 2, figs. 15, 16.

Ophiocoma bellis, Forbes, *Wern. Mem.*, vol. viii, p. 126; *British Star Fishes*, p. 53.

Ophiopholis bellis, Lyman, *Ill. Cat. Mus. Comp. Zool.*, No. I, p. 96, pl. 1, figs. 4–6.

Polypholis echinata (?), Duncan, *Journ. Linn. Soc.*, vol. xv, p. 73, pl. 3 (young).

Specimens of this species were dredged in August, off Port Erin, Isle of Man; depth twelve fathoms; bottom gravel and stones; also off Port St. Mary, from a depth of twenty fathoms.

Forbes * records it as occurring commonly in deep water off the Isle of Man.

Amphiura squamata, Delle Chiaje (sp).

Asterias squamata, Delle Chiaje, *Mem. sulla storia e anatomia degli animali del regno di Napoli*, pl. 34, fig. I, 1828.
Amphiura squamata, Sars, *Oversigt af Norges Echinodermer*, p. 21, 1861.
Ophiocoma neglecta, Forbes, *British Star Fishes*, p. 30.
Amphiura neglecta, Forbes, *Trans. Linn Soc.*, vol. xix, p. 150.
Amphiura elegans, Norman, Biology "Valorous" Cruise, *Proc. Roy. Soc. Lond.*, vol. xxv, p. 215.
Amphipholis lineata, Ljungman, Dr. Goës, *Öph. Of. Kong, Akad*, p. 634, 1871.

Specimens of this species were dredged during the cruise of the "Hyæna," in the Menai Straits, off Bangor, from a depth of ten fathoms; bottom muddy. It was again taken in August, from a depth of twelve fathoms, off Port Erin, Isle of Man; and from rock-pools at Fleshwick Bay, Port Erin, and elsewhere in that neighbourhood, almost always on *Corallina officinalis*.

Byerley (*loc. cit.*) records it at Hilbre Island, among seaweed and sponge. We have found it in great abundance under stones at low water spring-tides at Llandudno and Beaumaris; and, more sparingly, in deep water in the Menai Straits, from Puffin Island to Menai Bridge.

Ophiocoma nigra, Abildgaard (sp).

Asterias nigra, Abildgaard in Müll., *Zool. Dan.*, pl. 93, 1789.
Ophiocoma nigra, Müll. and Tr., *Wieg. Archiv*, p 328, 1840; *Ast.*, p. 100. Lyman, *Ill. Cat. Mus. Comp. Zool.*, No. 1, p. 81; *Syst.* Ludwig, *Anatomie der Ophiuren, Zeits. für Wissen. Zoologie*, vol. xxxi, p. 241.
Ophiocoma granulata, Forbes, *British Star Fishes*, p. 50.
Ophiocoma Nilsonii, Müll. and Tr., *Syst. Ast.*, p. 100, 1842.

Specimens of this species were dredged in August, from

* Forbes *A History of British Star Fishes.*

depths varying from ten to twenty fathoms, off Spanish Head, and from Port St. Mary to Calf, Isle of Man, bottom chiefly Nullipore and gravel.

Ophiothrix pentaphyllum, Pennant (sp).

Asterias pentaphyllum, Pennant, *Brit. Zool.*, vol. iv, pp. 54, 55, 1812.

Ophiothrix pentaphyllum, Ljungman, Dr. Goës, *Oph. Öf. Kong. Akad.*, p. 622.; Lyman, *Bull. Mus. Comp. Zool.*, vol. iii, part x, p. 249.

Ophiocoma rosula, Forbes, *British Star Fishes*, p. 60.

From a depth of fourteen fathoms, in the Sound between Puffin Island and Penmon, Anglesea, the dredge was brought up several times during the cruise of the "Hyæna," completely filled with specimens of this species. It was also obtained opposite Bangor, on May 24th. During August, it was found to occur in great numbers off Spanish Head and Port St. Mary, Isle of Man, at depths varying from ten to twenty fathoms; bottom chiefly Nullipore and gravel; and at low-water mark in Douglas Bay. It was also found at Penmaenmawr, in July. Byerley (*loc. cit.*) records it as occurring plentifully at Hilbre Island. We have found it in large numbers under stones and among the roots of *Laminaria* at low water spring-tides at Beaumaris, and in deep water at several points between that town and Puffin Island.

REPORT on the VERMES of the L. M. B. C. DISTRICT.

By R. J. Harvey Gibson, M.A., F.R.S.E., F.R.M.S.
DEMONSTRATOR OF ZOOLOGY, UNIVERSITY COLLEGE, LIVERPOOL.

Introduction.

The Vermes collected by the Liverpool Marine Biology Committee during the summer of 1885 form a fairly representative series of types of all the main groups. The Chætopoda, are especially well represented, numbering no less than thirty-seven out of the total number of forty-two species collected. Some of these are particularly interesting, not only as having been found here now for the first time, but also as having been observed only very rarely around our coast. Most of the Tubicolous Annelides are, however, common forms.

The classification I have adopted is that of Claus; * in the nomenclature of species I have followed McIntosh in his Monographs † on the various groups of British Vermes and his "Challenger" Report. I desire specially to acknowledge my indebtedness to Dr. McIntosh, F.R.S., for the uniform kindness with which he has answered many questions with regard to the identification of species with which I had difficulty.

Of the more important additions to our Fauna, as recorded by Byerley, the following seem worthy of special mention:—*Carinella linearis* among the Nemertea; *Lagisca propinqua*, *Harmothoë halicæti*, *Malmgrenia castanea*, *Iphione muricata*, *Hermadion assimile*, *Sthenelais zetlandica*, *Spio-*

* *Traité de Zoologie*, 1884.

† "Monograph on British Nemerteans," *Ray Soc.*, 1874. *Trans. Zool. Soc.*, vol, 9. *Trans. Roy Soc., Ed.* 1868-69. "Report on the Annelida," '*Chall.*' *Exp. Repts.*

chætopterus typicus, *Thelepus circinatus*, *Dasychone lucullana*, *Filograna implexa*, *Protula protensa*, among the Polychæta.

A few observations, more especially on the Polychæta of the collection, form a distinct paper.

Class.—Platyelmia.

Order IV.—NEMERTEA.

Sub-order.—ANOPLA.

Family.—Malacobdellidæ.

Malacobdella grossa, O. F. Müller.

A fine specimen of *Malacobdella grossa* was obtained parasitic in the shell of a live *Cyprina islandica*, which was found on Lavan Sands, Llanfairfechan.

Family.—Lineidæ.

Carinella linearis, Montagu.

An example of this species was dredged off Port Erin, Isle of Man. In colour, form, and anatomical features it agreed entirely with Montagu's description, as also with McIntosh's notes in his Ray Society Monograph on the Nemertea. The specimen was of a brick red colour, with white bands, when living, but after preservation in alcohol was of a yellowish white colour, the pale bands and annulations being pure white. Only about $1\frac{1}{2}$ in. of the worm was preserved, and that fragment tended to break into segments at the white annulations.

Lineus marinus, Montagu.

A specimen of this species was obtained in Bay Fine, Isle of Man, coiled around the dredge and its contents. The bottom was composed of stones and loose seaweed. A specimen was also found by Mr. R. D. Darbishire on the beach, east of Beaumaris.

This is the *Borlasia nigra* of Byerley's list.

Borlasia octoculata, Johnston.

Lineus sanguineus, Rathke.

Recorded by Byerley as having been found by Mr. Weightman on oysters.

Class.—Nematelmia.

Order.—CHÆTOGNATHA.

Sagitta bipunctata, Quoy and Gaimard.

This form was found in abundance by tow-netting off Port Erin. During July and August it seems to have occurred in greatest quantity when the water was rather rough and while a strong breeze was blowing. It does not occur in Byerley's list.

Class.—Gephyrea.

Order.—CHÆTIFERA.

Thalassema sp. (?).

One specimen of a species apparently belonging to the genus *Thalassema* was obtained at the entrance to the Menai Straits on the "Hyæna" expedition. The body had a length of 10 mm., while the sheath of the proboscis measured 25 mm. The sheath was grooved and, though swollen at the end, not bifurcated. The body was smooth posteriorly, but bore two spines anteriorly, ventrally placed and recurved. The alimentary canal was coiled, but the anus was terminal. I have not been able to make out as yet whether the species is one already described, and postpone further observations till I have investigated that point.

Class.—Annelida.

Sub-class.—Hirudinea.

Family.—RHYNCHOBDELLIDÆ.

Pontobdella muricata, Linnæus.

Found by Mr. Darbishire on skates at Southport, and also at Penmaenmawr.

Sub-class.—Chætopoda.

Order.—OLIGOCHÆTA.

Family.—Lumbricidæ.

Lumbricus lineatus, Müller.

Two small worms which I refer doubtfully to this species, were found in mud, in a dredging obtained off Hilbre Id., in company with *Sabellaria alveolata*. They were unmistakably Oligochæta of the genus *Lumbricus*, but I am doubtful as to the species. Carrington * mentions *L. lineatus* as being found in mud at Southport, though "very rare," so that the probability is that the examples obtained by the L. M. B. C. are not far off the form mentioned. Carrington also records *L. capitatus*, John., and *L. pellucidus*, Flem.

Order.—POLYCHÆTA.

Section A.—ERRANTIA.

Family. — Aphroditidæ.

Hermione hystrix, Savigny.

Two specimens of this form were obtained, one on a gravelly bottom at a depth of fifteen fathoms, half way between Port Erin and the Calf, Isle of Man, and one on a bottom composed of Nullipores, in twenty fathoms water, off Spanish Head, near Port St. Mary, Isle of Man. It does not occur in Byerley's list. It is noted as occurring at the Channel Islands, on the S. English coast, in the Mediterranean, and at St. Vincent. It is figured by McIntosh in his Report on the "Challenger" Annelides (pl. viii, fig. 3). *Hermione hystrix*, under the generic name of *Aphrodite*, is mentioned by Forbes † as having been found at the Isle of Man and S. Wales.

* "Polychæta of the Southport Shore." *Proc. Manch. Lit. and Phil.*, 1865.

† *British Assoc. Report*, 1850.

Aphrodite aculeata, Linnæus.

Mentioned by Byerley as having been found "once at Leasowe, and rarely on other parts of the shore;" and by Forbes (*loc. cit.*), as having been taken at the Isle of Man, and also by Carrington on the Southport sands. A specimen of *A. aculeata* was dredged by the L. M. B. C. in the Channel between Puffin Island and Anglesea. It has also been frequently brought for the Liverpool Museum Aquaria by Liverpool fishermen; and used to be found occasionally at Egremont, and on the Bootle shore, by the Museum Collector, Mr. Wood.

Family.—Polynoidæ.

Lagisca propinqua, Malmgren.

One specimen of this species was obtained in Hilbre Swash, from a depth of four fathoms. The specimen was in a rather mutilated condition, but the characteristic markings on the spines, the scales, the dark spots at the bases of the feet, and the absence of the tentacle proved its identity with Malmgren's species, corresponding with McIntosh's figures.* The colouring of the head region did not agree with McIntosh's description, but the colour is not of much specific value.

The species does not occur in Byerley's list; it is mentioned, however, by McIntosh as having been found at St. Andrews and Shetland.

Harmothoë lunulata, Delle Chiaje.

Polynoë maculosa, Carrington, *Proc. Manch. Lit. Phil. Soc*, 1865.

This species is described by McIntosh (*loc. cit.*) and by Carrington (*loc. cit.*), in detail.

Acholoë asterícola, Delle Chiaje.

Polynoë asterinæ, Carrington, *Proc. Manch. Lit. and Phil*, 1865.

This species is described both by McIntosh and Carring-

* *Trans. Zool. Soc.*, vol. ix, p. 376, pl. lxvii, 12.

ton; by the latter as being found commensal on *Astropecten irregularis* (*Asterias aurantiaca* of Forbes) from Southport.

Harmothoë haliæti, McIntosh.

This species was first dredged in fifty-three fathoms in the Minch by Dr. Gwyn Jeffreys, and afterwards during the "Knight Errant" Expedition in the Faroë Channel. McIntosh describes and figures the species in the *Trans. Zool. Soc.* (*loc. cit.*), and the body and scales in the "Challenger" Report (p. 96). Unfortunately the scales in the specimen obtained by the L. M. B. C. were absent; the spines, position of the eyes, and cirri, however, agree with McIntosh's account. The specimen was found at Port Erin, Isle of Man, in about fifteen fathoms water. It was about 20 mm. in length. It is not recorded by Byerley.

Harmothoë imbricata, Linnæus.

A large number of examples of this form were found under stones, and on rocks and loose stones, covered with seaweed, and also abundantly in rock pools. They were most plentiful at low water-mark. Most of the specimens were obtained at Bay ny Carrickey, between Port St. Mary and Poyllvaaish, Isle of Man. A few were also obtained from Hilbre and the Anglesea coast. Probably this is the *Polynoë cirrata* of Byerley's and Carrington's lists. The latter mentions them as "very rare"; that may, no doubt, be explained by their preferring a rocky shore.

Malmgrenia castanea, McIntosh.

This rather rare species, which has not been previously recorded as having been observed on this coast, was found as a commensal in the ambulacral groove of *Astropecten irregularis*, between the rows of pedicels. The head of the worm was level with the peristome. It has been dredged by Gwyn Jeffreys off North Unst, Shetland, in ninety to ninety-six fathoms, in 1867, and again in 1868, as a commensal near

the mouth of *Spatangus purpureus*, from a depth of eighty-five fathoms, and a shell-sand bottom. He also obtained it in eighty fathoms off Valentia, in a hundred and ten fathoms off Blasquet, and in the Channel Islands (McIntosh, *Trans. Zool. Soc.*, *loc. cit.*) The two specimens obtained by the L. M. B. C. were dredged with their host from a depth of fourteen fathoms from a sandy bottom, six miles north of the Great Ormes Head. The species is fully described but not figured (save the spines) by McIntosh (*loc. cit.*)*

Iphione muricata, Savigny.

One specimen of this species was obtained from the Beaumaris shore. It was very large, but all the scales were unfortunately removed. There was, however, no difficulty in including it under Savigny's species, with which it agreed in the structure of the head, spines, and cirri. McIntosh, in the Report on the "Challenger" Annelida, describes this form, which he contrasts with *Iphione cimex*, collected on that expedition. Savigny describes and figures *Iphione muricata*.†

Polynoë floccosa, Savigny.

One large and two small specimens of this *Polynoë* were found along with *Harmothoë imbricata* at Bay ny Carrickey. It is a common form round our coast, and is described and the spines figured in the *Trans. Zool. Soc.* (*loc. cit.*), by McIntosh. It is not recorded by Byerley.

Polynoë squamata, Linnæus.

A number of examples of *Polynoë squamata* were found on the shore at Hilbre, and also in dredgings in eight fathoms in Hilbre Swash from a gravel bottom. One small specimen was obtained at Port St. Mary, Isle of Man. Byerley mentions it as having been found at Hilbre and at New Brighton.

* *Syst. des Annél.*, p. 21 and pl. iii, fig. 1.

† Vid. *Notes on some of the Polychæta of the L.M.B.C. District Report I.*

The species is worked out in detail by Bourne.*

Carrington (*loc. cit.*) mentions two varieties of this form, both of which occur in the collection of the L. M. B. C. The markings on the scales are, however, very variable.

Hermadion assimile, McIntosh.

This form was first found by McIntosh at St. Andrews, and afterwards (according to that author) "on the west coast of Ireland, south of England, and off the Spanish coast in the 'Porcupine' expedition." The species is described by McIntosh in *Trans. Zool. Soc.* (*loc. cit.*) Two examples were found by the L. M. B. C. They were coiled round the peristome of *Echinus esculentus* hidden by the peristomial spines. The *Echinus* was dredged from a gravel bottom, in ten fathoms water, at Bay Fine, near Port Erin, Isle of Man. The species has not been previously recorded from this coast. Most of the scales fell off so soon as the animal was removed from the *Echinus*, otherwise both examples were very perfect and agreed entirely with the characters of the species as laid down by McIntosh.†

FAMILY.—SIGALIONIDÆ.

Sthenelais zetlandica, McIntosh.

This form, first dredged by Gwyn Jeffreys, off Shetland, was met with near Port Erin. One specimen only, was obtained in the dredge, in twenty fathoms of water. The example from which McIntosh described the species was a fragmentary one, the anterior region being injured and the head absent. His description of those parts which he was able to observe tallies, however, with the specimen obtained at Port Erin. The head was absent also in the Port Erin specimen, and from the length of the fragments obtained one being over 30 mm. long), after having been for some

* *Trans. Linn. Soc.*, 1883.

† Vid. *Notes on some of the Polychæta of the L.M.B.C. District Report I.*

months in spirit), the complete animal appears to be of considerable dimensions.

Pholoë minuta, Fabricius.

Pholoë inornata, Johns.

Mentioned by Carrington * as having been very rarely found on the sands at Southport. It was not found by the L. M. B. C., although, it is true, comparatively little shore work was done on the expeditions.

Sigalion sp. (?).

Carrington (*loc. cit.*), describes a *Sigalion* as having been found at Southport (*Sigalion Carringtonii*, C. H. Brown), which does not however seem to be recognised by subsequent authors.

Family.—Nepthyidæ.

Nepthys longisetosa, Oersted.

Nepthys hombergii, Aud. & M. Edw.

One specimen of this form was dredged off Hilbre Island. It is a native of the Mediterranean and the North Sea, and has been found at Hilbre, and recorded by Byerley under the synonym of *Nepthys hombergii*.

A small fragment of a worm, which was, by its spines, referred to this species, was obtained at Port Erin.

Carrington records *N. hombergii*, from Southport Sands.

Nepthys margaritacea, Sars.

Recorded by Carrington from Southport.

Family.—Phyllodocidæ.

Eulalia viridis, O. F. Müller.

A small specimen of this species was obtained in the "Hyæna" Expedition, off Great Ormes Head. The proboscis was very long and fully everted. The specimen

* *Proc. Manch. Lit. and Phil.*, 1865.

seems to have been young, and the spines were small and in various stages of development. This is probably the *Phyllodoce viridis* of Byerley's list.

Phyllodoce lamelligera, Johnston.
Phyllodoce vittata, Ehlers.
Phyllodoce attenuata, Carrington.
Phyllodoce clava, Carrington.

These species are all recorded by Carrington as having been found by him on the sands at Southport. Probably his *P. clava* is *P. clavigera* (of Aud. and Ed.). *P. attenuata* seems to be only a variety of *P. lamelligera*. None of these were however obtained by the L. M. B. C., probably for the reason already assigned, viz., that no systematic shore exploration has yet been organised.

Family.—Syllidæ.

Syllis armillaris, O. F. Müller.

Three specimens were obtained in the dredge in eleven to thirteen fathoms north of Puffin Island, on the Anglesea coast. It is mentioned by Byerley as being rare on this coast.

Syllis prolifera, Müller.

Mentioned by Carrington as "abundant in wet places, but covered by a stratum of mud, and hence, as also from its minute size, easily overlooked."

Pollicita peripatus, Johnston.

Carrington says, "Several specimens were found at the base of *Alcyonium digitatum* brought from deep water after storms."

Syllis noctiluca, Savigny.

This form was found by Dr. Edwards, and recorded by Byerley, from the mud at the Landing Stage, Liverpool. It

has probably been exterminated during the formation of the new stage.

Myrianida fasciata, M.-Edwards.

Found at Hilbre by Byerley, but not observed since.

Family.—Nereidæ.

Nereis pelagica, Linnæus.

Abundant at Hilbre and the coast generally; also at Puffin Island, Anglesea, and Penmaenmawr. Some large specimens were obtained at Port St. Mary, Isle of Man. It is probably the *Nereis margaritacea* of Byerley's list.

Nereis viridis, Linnæus.

This species was also obtained from Port St. Mary, Isle of Man. Byerley mentions it, but does not specify the locality.

Both this species and *N. pelagica*, are recorded by Carrington from Southport.

Nereis brevimana, Johnston.

Nereis margaritacea, Leach.

Nereis dumerillii, Aud. and M.-Edw.

Nereis bilineata, Johnston.

These species are all recorded by Carrington as having been found in refuse of fishing-boats, &c., at Southport.

Family.—Lumbriconereidæ.

Lumbriconereis fragilis, O. F. Müller.

One specimen of this species was obtained from Port St. Mary, Isle of Man, and fragments of three or more from Puffin Island, Anglesea. It is described by Müller as being common in the North Sea, and was found during the "Porcupine" expedition, in fifty-three fathoms, near the island of Rona.

Family.—Eunicidæ.

Eunice sp. (?)

One or two fragments of Annelides were obtained from

Port St. Mary, Isle of Man, which from their general appearance and from the structure of the spines were obviously to be referred to the genus *Eunice*, but the species could not be made out with certainty.

Family.—GONIADIDÆ.

Goniada maculata, Johns.

This species is recorded by Carrington from Southport, but neither that, nor the following one, was collected by the L. M. B. C.

Goniada alcockiania, Carrington.

This species has not been included by more recent writers on the Annelida. If identical with a previously-named species, I have not been able to discover its synonym.

Family.—GLYCERIDÆ.

Glycera alba, Müller.

Mentioned by Carrington (*loc. cit.*), as having been found by him "among the tufts of *Antennularia antennina*."

Section B,—SEDENTARIA.

Family.—OPHELIADÆ.

Ophelia coarctata, M.-Edw.

Recorded by Carrington from Southport.

Family.—MÆADÆ.

Mæa mirabilis, Johnston.

A rare Annelid, first described by Johnston, and found by Carrington at Southport.

Family.—CHÆTOPTERIDÆ.

Spiochætopterus typicus, Sars.

A large example of this species was found at low water at Beaumaris. The specimen inhabited a pergamentaceous tube

which was buried in shingly sand. The specimens obtained in the "Porcupine" Expedition, were dredged from five hundred fathoms. McIntosh however, remarks that the species found by the "Challenger," were all shallow water forms.

Family.—Spionidæ.

No members of this family were found by the L. M. B. C., but the following species are recorded by Dr. Carrington, from Southport:—

Spio seticornis, Fabricius. Probably this is the *Spio crenaticornis* of Montagu.

Spio quadricornis, Lamarck.

Nerine vulgaris, Johnston (doubtfully).

Nerine coniocephala, Johnston.

Family.—Telethusidæ.

Arenicola piscatorum, Lamarck.

Everywhere abundant, and used for bait along the coast, from the Dee estuary northwards.

Family.—Cirratulidæ.

Cirratulus borealis, Lamarck.

Very abundant on the Cheshire coast. A large number of species were obtained also at various places on the coast, near Port St. Mary and Port Erin, Isle of Man, under stones, in mud, and amongst decaying Algæ.

Cirratulus cirratus, O. F. Müller.

One specimen was dredged off Port St. Mary, Isle of Man, but was in a rather mutilated condition. It has not been recorded before from this locality.

Family.—Hermellidæ.

Sabellaria alveolata, Savigny.

Sabellaria anglica, Grube.

The tubes of this species form great encrusting masses

at Hilbre and other places on the coast. Tubes were also dredged in Hilbre Swash, and trawled in eight fathoms water off the Great Ormes Head. Very large beds are also to be found near the Lighthouse, at Fleetwood. Its geological significance has been referred to by Herdman.*

It is recorded by Byerley as being very abundant at New Brighton, Caldy Blacks, and Hilbre.

Carrington also mentions it under the synonym of *S. anglica*, as being parasitic on the whelk and other shells.

Sabellaria crassissima, Lamarck.

"Rare" (Carrington).

Sabella unispira, Savigny (?).

The worm recorded as *Sabellaria unispira* by Byerley, is probably *Sabella unispira* of Savigny, and as such is marked "a doubtful species" in the *Brit. Assoc. List*, 1860, and does not appear in subsequent lists.

Family.— AMPHICTENIDÆ.

Pectinaria belgica, Pallas.

Recorded by Carrington.

This species was dredged in six to seven fathoms on a sandy bottom from the west end of Constable Bank, Llandudno; from a gravel bottom in twenty fathoms at Port Erin, Isle of Man; and at low water, in great abundance, on Waterloo shore.

Pectinaria auricoma, O. F. Müller.

This is the *Amphitrite auricoma* of Byerley's list.

These two forms seem to be in want of re-description in order to decide whether there are any real points of distinction.† Many empty tubes were obtained which might have belonged to this species, but no live forms were obtained in the collection of the L. M. B. C.

* *Proc. Geol. Soc. Liverpool*, Sess. 1884–5.

† See separate Paper on this subject further on in this volume.

Ops, spp. (?).

Carrington describes two new species of a genus *Ops*. I am in some doubt as to the name as the genus does not seem to be recognised by more recent investigators.

Amphitrite ventilabrum, Riss.

Mentioned by Byerley as often confounded with *A.* (*Pectinaria*) *auricoma*.

No example was dredged by the L. M. B. C. *Sabella ventilabrum* of Carrington's list is probably the same form.

Family.—Chloræmidæ

Siphonostomum gelatinosum,

Dr. Herdman informs me that he found and identified an example of this species at Hilbre, on July 11th, 1885. The worm was unfortunately not preserved.

Family.—Terebellidæ.

Terebella conchilega, Pallas.

This common form was obtained plentifully at Hilbre. It is recorded by Byerley and by Carrington as having been found generally about the shore. A number of specimens were also obtained from Port Erin, Isle of Man.

Terebella crysodon, Montagu.

Terebella coustrictor, Montagu.

These forms are mentioned by Carrington, but were not found by the L. M. B. C.

Terebella nebulosa, Grube.

Found abundantly in the dredge off Port Erin, Isle of Man, its muddy tubes coiled in the interior of large lamellibranch shells, &c.

Recorded from Hilbre by Byerley.

Thelepus circinatus, Fabricius.

One specimen of this form was obtained from Penmaen-

mawr. The species was dredged by the "Knight Errant" off the north coast of Scotland in 1880. It does not appear in Byerley's list.

Family.—Sabellidæ.

Sabella penicillus, Linnæus.

Sabella pavonia, Savigny.

One very large specimen and a few smaller ones were obtained, the former in the dredge off the Great Ormes Head, the latter at Hilbre. It is not recorded by Byerley.

Dasychone lucullana, Delle Chiaje.

Two specimens of the animal were obtained, but no tubes. They were dredged off Puffin Island, on the Anglesea coast, from a depth of twelve fathoms. It does not occur in Byerley's list.

Family.—Serpulidæ.

Serpula vermicularis, Linnæus.

This species, the common *Serpula*, is found abundantly over rocks and shells on the coast. Specimens were obtained from Hilbre, and plentifully at the Isle of Man. It occurs in Byerley's list.

Serpula triquetra, Linnæus.

This form was obtained at Penmaenmawr, and is recorded by Carrington, and by Byerley, under the synonym of *Vermilia triquetra*.

Spirorbis borealis, Davidson.

Spirorbis communis, Fleming.

This Serpulid is very abundant on the seaweed, stones, &c. on the shore. Some very fine specimens were found encrusting *Corallina officinalis*, at Fleshwick Bay, Isle of Man. Mentioned by Carrington under the synomyn *S. communis*.

Spirorbis lucidus, Montagu.

Spirorbis minutus, Montagu.

Both mentioned by Carrington. *S. lucidus* is recorded by Byerley.

Byerley also mentions *S. nautiloides* and *S. rugosa*. I have not been able to discover for what these names are synonyms; neither specific name occurs in any list of *Spirorbes* that I am acquainted with.

Filograna implexa, Berkeley.

This species was obtained at low water, between Port St. Mary and Spanish Head, Isle of Man, attached to the roots of *Laminaria*. It is not recorded by Byerley.

Protula protensa, Grube.

A number of tubes of this form were dredged between Port St. Mary and Spanish Head, Isle of Man, depth, twenty fathoms. No animals were found however, in the tubes, and they have been referred to this species doubtfully. It has not been recorded by Byerley, but was dredged during the "Porcupine" expedition, in five to thirty fathoms, north of the Island of Rona.

——— ——— (?).

Certain tubes of small size forming an irregular mass were dredged at Port Erin, Isle of Man. No inhabitants were found in the tubes. They are leathery, and resemble some Annelid tubes. Dr. McIntosh, F.R.S., to whom I referred the matter, gives it as his opinion that they are the tubes of a Crustacean, probably a species of *Cerapus*, but thinks it unsafe to dogmatise.

Family.—TOMOPTERIDÆ.

Tomopteris onisciformis, Eschscholtz.

Young specimens of this form were found in the tow-net off Port Erin, Isle of Man, on August 7th, 1885. This is the common *Tomopteris* of the British seas, and does not call for more detailed notice. It is not recorded by Byerley.

REPORT on the POLYZOA of the L. M. B. C. DISTRICT.

By Joseph Lomas,

ASSOCIATE OF THE NORMAL SCHOOL OF SCIENCE.

Introduction.

In the autumn of 1751, a collection of Sea-plants and Corallines, gathered from the shores of Anglesey and Ireland, was sent to a London merchant named Ellis.

He disposed of this material "on thin boards covered with clean white paper, in such a manner as to form a kind of landscape, making use of two or three sorts of *Ulva marina* or Sea-Liverwort, of different colours, in designing a variety of hills, dales, and rocks, which made proper groundwork and keeping for the little trees, which the expanded Sea-plants and Corallines not unaptly represented." *

Her Royal Highness the Princess Dowager of Wales was pleased to accept some of these landscapes from Mr. Ellis, and, in order to get a greater variety, he collected specimens from other localities.

While examining and arranging this material by means of a microscope "in order to distinguish their proper characters with the greater accuracy," he soon discovered "that they differed not less from each other, in respect to their form, than they did in regard to their texture; and that, in many of them, this texture was such, as seemed to indicate their being more of an animal than vegetable nature." †

Peysonnel, a French physician, had made this discovery

* Ellis, *Corall., Introd.*, p. v. † *Ibid.* p. vi.

some time before, but he was discredited, and the leading naturalists of the day stoutly opposed his views.

In 1755, Ellis published an *Essay towards a Natural History of the Corallines*, in which he described and figured the forms he believed to be animals. Considering the means of observation at his command, the illustrations strike us with wonder on account of their marvellous accuracy.

Among the Corallines, he described a considerable number of Polyzoa, so I think we can fairly claim that Ellis was the first one to work at this group of animals in our neighbourhood.

Since that time other eminent naturalists have been attracted to this field of labour. Notable amongst these I may mention Prof. E. Forbes, F.R.S., and the Rev. Thos. Hincks, B.A., F.R.S., whose invaluable work on the *British Marine Polyzoa* has furnished a great portion of the material for this report.

The whole of our district, however, has not been thoroughly examined, for while the Isle of Man, the coast of North Wales, and the neighbourhood of Hilbre Island have been the favourite resorts of collectors, the coast of Lancashire, particularly the part extending from Liverpool to Blackpool, seems to have been almost untouched.

Up to the present I have been able to record ninety-eight species occurring in our area, divided among the four great groups as follows :—

Cheilostomatous forms 66.
Cyclostomatous forms 13.
Ctenostomatous forms 17.
Entoproctous forms 2.

One species I insert with considerable hesitancy—viz., *Membranipora flemingii*. In the *British Marine Polyzoa* it is described as "common, and generally distributed on our coasts," but no special localities are given. But as we could

not expect to get all the common forms even, as the result of one season's labour, we may hope for additions to our lists as the results of further search.

I have followed mainly the classification of Mr. Hincks, as laid down in the *British Marine Polyzoa*, with a few alterations rendered necessary by the researches of Prof. Lankester.*

In conclusion, I must express my gratitude to the Rev. Thos. Hincks, B.A., F.R.S., whose valuable help in determining species, about which I was in doubt, has always been very willingly given; to Mr. Quelch, B.Sc., of the Natural History Museum, South Kensington, for kindly placing the National Collection at my disposal for reference, and also for kindly advice and help in naming the specimens; and to Professor Herdman, D.Sc., whose valuable assistance, amid pressing avocations, has always been most readily accorded me.

Class.—**POLYZOA.** J. V. Thompson.

Syn. *Bryozoa.* Ehrenberg, &c.
Tentaculibranchia. E. Ray Lankester.

Section.—Eupolyzoa. E. R. Lankester.

Sub-Class.—Ectoprocta. Nitsche.

Order.—GYMNOLŒMATA. Allman.

Syn. *Polyzoa infundibulata* Busk, *B. M. Cat.*

Sub-order. I.—CHEILOSTOMATA. Busk.

Syn. *Celleporina.* Ehrenberg.

Family I.—AETEIDÆ.

Genus *Aetea*, Lamouroux.

Only three species of *Aetea* have been found in British Seas, and they are all represented in our area.

* *Ency. Brit.*, 9th edit.; article "Polyzoa."

Aetea anguina, Linnæus.

Anguinaria spatulata, Lamk., *An. s. Vert.* (ed. 2) ii, 196. Busk, *Trans. Micr Soc.* for 1849, 123, pl. i, figs. 7, 8. Johnston, *B. Z.*, (ed. 2), 290, pl. i. figs. 7, 8.

Found in great abundance on Hydrozoans cast up on shore at West Kirby (Lomas); also occurs at Ramsay, Isle of Man, and Llandudno (Hincks). Holyhead (Higgins).

Aetea recta, Hincks.

Hippothoa sica, Johnston, *B. Z.* (ed. 2) 292.

Smitt (*Œfvers K. Vel-akad, Förhandl*, 1867), regards this as a variety of *A. anguina*.

Occurs in the Isle of Man (Hincks). Dredged in considerable abundance by Professor Herdman, off Port Erin, (ten to fifteen fathoms).

Aetea truncata, Landsborough.

Anguinaria truncata, Landsb. (*Pop. Hist. Brit. Zooph.*, 288).

Common in the Isle of Man, on oyster-shells (Hincks). Erect and composite forms near Port Erin (ten to fifteen fathoms), on sea-weed.

Family II.—Eucratiidæ.

Genus *Eucratea*, Lamouroux.

Syn. *Sertularia* (part). Linn.
Scruparia, Busk.

Only two species have been described belonging to this genus, *E. ambigua*, D'Orb., a native of South America, and *E. chelata*, abundant in Australia and Europe.

Eucratea chelata, Linn.

Scruparia chelata, Busk, *B. M. Cat*, i, 29.

In the *British Marine Polyzoa* Mr. Hincks describes two varieties of this species :—

Var. *α. repens*. Zooecia decumbent and adnate; aper-

ture scarcely marginate, branches given off from the sides of the cells (B. M. P., plate v. fig. 3).

Var. *β. gracilis.* Zooecia very slender and elongate, tubular below and enlarged above.

While examining the material dredged by Professor Herdman last summer about the south-west coast of the Isle of Man, I came across some forms of this species which were very much more elongated than the forms described and figured in the B. M. P.

This character held for a great number of specimens, and it may be well to class them as a distinct variety, (*γ*) *elongata*, of which I give a figure. (See Plate III, fig. 1.)

Var. *α. repens* was dredged by Mr. Hincks off the Maughold Head, near Ramsey, "where it is common, and spreads in rather large dendritic patches over oysters and other shells."

Bangor, Rhyl (Shrubsole). Beaumaris (Walker). Holyhead (Higgin).

Genus *Gemellaria*, Savigny.

Syn. *Crisia* (sp.) Lamx., Lamk.

This genus only includes one British species.

Gemellaria loricata, Linn.

Gemellaria loricata, Johnston, *B. Z.*; Alder.
Cellaria loriculata, Ellis & Sol.; Lamk.

Found in great abundance on the Lancashire coast at Lytham, &c. Llandudno (Hincks). Rhyl (Shrubsole). Puffin Island (Walker). Hilbre I. (Lomas).

Dredged in the "Merry Andrew" Expedition (May 9th), (ten to eleven fathoms), at Hilbre Swash.

Family III.—Cellulariidæ.

Syn. *Cellularidæ.* (part). Johnst., *Brit. Zooph.*
Cellulariadæ, Busk, *B. M. Cat.*
Cabereadæ. id. ibid.
Cellularieæ (part), Smitt.

Genus. *Cellularia*, Pallas.

Only one British member of this genus.

Cellularia peachii, Busk.

Cellularia neritina, var., Johnston.

Given as occurring near Liverpool, by Byerley.

Genus. *Scrupocellaria*, Van Beneden.

Syn. *Cellularia*, Pall., Johnst., Smitt.
Canda, Busk.

This genus forms a large group, and is widely distributed. About twenty species are known. Found sparingly in northern latitudes, but more common in southern seas. Five British species.

Scrupocellaria scruposa, Linn.

Cellularia scruposa, Pall., Flem., Johnst., Smitt.

Generally distributed around our coasts (Hincks). Isle of Man. Penmaenmawr (Lomas). Hilbre Island (Rev. H. H. Higgins). Colwyn Bay (Shrubsole, Walker). Holyhead (Higgin).

Scrupocellaria scrupea, Busk.

Found on shore at West Kirby (Lomas), and dredged off Port Erin (five to ten fathoms), by Professor Herdman ; and in the " Merry Andrew " Expedition, at Hilbre Swash (ten to eleven fathoms). North Wales (Shrubsole). Not previously recorded in this district.

Scrupocellaria reptans, Linn.

Cellularia reptans, Pall, Johnston, Smitt.
Canda reptans, Busk, *B. M. Cat*

Very common. Isle of Man, on *Pecten* and *Laminaria;* Penmaenmawr, West Kirky, &c. Colwyn Bay and Beaumaris (Walker). Holyhead (Higgin).

Family IV.—BICELLARIIDÆ.

Syn. *Bicellariæ*. Smitt,

Genus *Bicellaria*, Blainville.

Syn. *Cellularia.* Pallas (part), Flem., Johnst.
Crisia (part) Lam., Van Ben.

Confined to Australian Seas, except two British forms, *B. ciliata* and *B. alderi* (N. Scotland).

Bicellaria ciliata, Linn.

Cellularia ciliata, Pall., Flem., Johnst.
Crisia ciliata, Lam., Van Ben.

Fleetwood, on a buoy; Menai Straits (Hincks). West Kirby, on Algæ, abundant. Hilbre (Lomas). Bangor and Southport (Pennington). Rhyl (Shrubsole). New Brighton (Marrat). Bootle (Tudor). Colwyn Bay (Walker). Holyhead (Higgin).

Genus *Bugula*, Oken.

Syn. *Cellularia*, Pall., Johnst.
Bugulina, Gray.
Avicularia, J. V. Thompson, Gray.

Very widely distributed. Eight British species are known.

Bugula turbinata, Alder.

Dredged off Gt. Orme's Head; Isle of Man (Hincks); Menai Straits (Alder); Hilbre Island, in great abundance (Lomas). Colwyn Bay (Shrubsole).

Bugula flabellata, J. V. Thompson.

Flustra avicularis, J. Sowerby, Flem., Johnst.
Bugula avicularia, Smitt.

On *Flustra*, Isle of Man (Lomas); Bootle (Tudor); Llandudno, N.W. (Hincks); West Kirby (Lomas); Menai Straits (Pennington); Seacombe (Marrat). Colwyn Bay (Shrubsole).

Dredged during the "Hyæna" Expedition.

Bugula avicularia, Linn.

Sertularia avicularia, Linn.
Cellularia avicularia, Landsb., &c.

Blackpool (Pennington); Hilbre Island (Byerley); Colwyn Bay (Shrubsole). Holyhead (Higgin).

Bugula plumosa, Pallas.

Crisia plumosa, Lamx.
Crisularia plumosa, Gray, *B. M. Cat.*, Rad. iii.
Cellularia plumosa, Pallas, Couch.

Found at Fleetwood on a buoy (Hincks.)

Very beautiful specimens have been dredged during the summer off Penmaenmawr by Mr. Thompson, and off Port Erin by Prof. Herdman; Menai Straits (Pennington), Bootle Shore and Hilbre (Marrat).

Bugula purpurotincta, Norman.

Cellularia plumosa, Johnst., *B. Z.*, Sars.
Bugula fastigiata, Alder, *Cat. Zooph., North and Durham*, 59.
Bugula avicularia forma fastigiata, Smitt.

Menai Straits (Hincks).

This is a northern form, and Menai Straits is the most southern locality yet noted.

Genus *Beania*, Johnst.

Only one British representative.

Beania mirabilis, Johnston.

Found on weed, Isle of Man (Hincks).

Dredged by Prof. Herdman off Port Erin (five to ten fathoms).

Family V.—Notamiidæ.

With single representative *Notamia bursaria*, Linn., not found in our area.

Family VI.—Cellariidæ.

Syn. *Escharidæ* (part), Johnst.
Salicornaridæ, Busk.
Cellarieæ, Smitt.

Genus *Cellaria*, Lamouroux (part).

Salicornaria, Cuvier, Johnst., Busk.
Farcimia, Fleming.

This genus ranges from New Zealand and Tasmania to Spitzbergen, and geologically as far back as the Cretaceous epoch.

It was obtained during the "Challenger" expedition at depths from 2,000 to 3,000 fathoms. Three British species.

Cellaria fistulosa, Linn.

Salicornaria salicornia, Cuvier.
Farcimia fistulosa, Flem.
Salicornaria farciminoides, Johnst., Busk, Reuss.

Hincks (*Brit. Mar. Poly.*, 106) gives no less than twenty-four synonyms which have been applied to this species.

Generally distributed. Dredged in large quantities in the Isle of Man by Prof. Herdman off Spanish Head (twenty fathoms). Colwyn Bay (Shrubsole). Isle of Man (twenty-five fathoms) (Forbes). Holyhead (Higgin).

This species is met with at great depths, being found on the Falmouth and Lisbon Cable at 89 to 205 fathoms (Sir James Anderson).

Family VII.—Flustridæ.

Syn. *Escharidæ* (part), Johnst., Pall.
Flustradæ (part), Busk.

Genus *Flustra*, Linn.

Syn. *Eschara* (part), Pallas, Linn.
Flustra sp., Linn., Lamk., Johnst., Busk, Smitt.
Carbasea, Gray, Busk.

Universally distributed. Most abundant in northern latitudes. Five British species.

Flustra foliacea, Linn.

Eschara foliacea, Linn, Ell. and Sol., Lamk., Van Ben.

Found everywhere. Very abundant at Hilbre Island, West Kirby, New Brighton, Holyhead, Isle of Man, &c., at low-water mark.

Flustra papyracea, Ellis and Sol.

Flustra chartacea, Couch, Johnst.

Hilbre, very scarce (Byerley).

Flustra carbasea, Ellis and Solander.

Carbasea papyracea, Gray, *Bt. M. Cat.*
Carbasea Papyrea, Busk, *B. M. Cat.*, Alder.

Bootle, rare (Tudor).

Flustra securifrons, Pallas.

Narrow-leaved hornwrack, Ellis.
Eschara securifrons, Pallas.
Flustra truncata, Linn., Lamk., Flem., Johnst., Busk.

Chiefly a northern form. Rhyl (Shrubsole). Not previously recorded.

Family VIII.—Membraniporidæ.

Syn. *Celleporidæ*, Johnst.

Genus *Membranipora*, Blainville.

Syn. *Flustra* (part), Linn, Lamk., Flem., Lam.

Has a wide range both in space and time, ranging to the Cretaceous epoch. 23 British species.

Membranipora lacroixii, Audouin.

Biflustra lacroixii, Smitt., Flor., Bryoz.
Membranipora membranacea, Johnst.
Flustra lacroixii, Savigny.

Ramsey, Isle of Man, on stones in tide-pools (Hincks). Altcar and New Brighton on *Buccinum* (Lomas). Colwyn Bay (Shrubsole).

Membranipora monostachys, Busk.

Membranipora pilosa forma Monostachys, Smitt.

Dredged on a stone in Liverpool Bay, by Professor Herdman. Not previously recorded in this district.

Membranipora catenularia, Jameson.

Hippothoa catenularia, Flem., Johnst., Busk.

Isle of Man, dredged by Prof. Herdman. Not previously recorded in our district.

Membranipora pilosa, Linnæus.

Flustra pilosa, Linn, Lamk., Flem.
Annulipora dentata, Gray.

This species is found everywhere, and is the most abundant form met with in our seas.

The masses of sea-weed left by the tide at high-water mark are frequently found covered with it.

On Sertularians, it usually has the appearance of a brown hairy covering, but when found on *Laminaria*, or red Algæ, it forms a beautiful silvery crust.

Membranipora membranacea, Linn.

Flustra membranacea, Linn., Ellis and Sol., Johnst., &c.

Found mostly on *Fuci*, and is very generally distributed. (Byerley). North Wales (Shrubsole). Hilbre (Marrat). It is remarkable that this species, which is regarded as a very common one, was not once met with among the specimens collected during the present season.

Membranipora hexagona, Busk.

Flustra coriacea, Johnst.

Found on shells and stones. Only a few localities have been recorded where this species occurs, viz. :—Isle of Man on *Pecten opercularis* (E. Forbes), and on the coast of Devon (Miss Cutler), Peterhead (Peach).

Membranipora lineata, Linnæus.

Flustra lineata, Linn., Johnst.
Callopora lineata, Gray.

Common in the Isle of Man. Forms rounded patches on *Laminaria*.

Membranipora craticula, Alder.

Flustra lineata, Couch.
Membranipora lineata forma craticula, Smitt.

Very abundant on shells dredged off Maughold Head, Isle of Man (Hincks).

Membranipora spinifera, Johnston.

Flustra lineata (part), Johnston.

Isle of Man, between tide marks (Hincks).

Membranipora flemingii, Busk.

Membranipora membranacea (part), Johnst.

Common, and widely distributed (Hincks).

Membranipora dumerilii, Audouin.

Membranipora membranacea (part), Johnst.
Membranipora flemingii, Busk, *B. M. Cat.*
Membranipora pouilletii, Alder, Busk, *Crag Polyzoa*.

Isle of Man (Hincks).

Membranipora rosselii, Audouin.

Flustra rosselii, Aud., Savigny.

Off Maughold Head, Isle of Man (Hincks).

Membranipora aurita, Hincks.

Found on a piece of wood near Spanish Head, Isle of Man. Not previously found in our area, and the only other localities are Devon and Cornwall (Hincks), Antrim (Hyndman), Northumberland (Alder), and Brighton on flints (Lomas).

Family IX.—Microporidæ.

Membraniporidæ (part), Busk.

Genus *Micropora*, Gray.

Syn. *Discopora* (part), Lamarck.
Membranipora (part), Busk

Two British species.

Micropora coriacea, Esper.

Flustra coriacea, Esper.
Membranipora coriacea, Busk, *B.M Cat.* ii.

Isle of Man (Forbes).

Family X.—Cribrilinidæ.

Syn. *Escharidæ* (part), Johnston.
Membraniporidæ (part), Busk.
Eschariporidæ (part), Smitt.

Genus *Cribrilina*, Gray.

Syn. *Lepralia* (part), Johnst., Busk.
Escharipora, Smitt.

Five British species.

Cribrilina radiata, Moll.

Lepralia innominata, Couch., Johnst., Busk., &c

A Mediterranean form, abundant on south and south-west coasts of England, ranging to Isle of Man (Hincks).

Cribrilina punctata, Hassall.

Lepralia punctata, Has., Johnst., Busk

Isle of Man (Hincks).

Found on wood near Spanish Head, Isle of Man.

The punctures are very large, and arranged regularly, forming a beautiful network over the front of the cell.

Cribrilina annulata, Fabricius.

Lepralia annulata, Johnst., Busk.

Isle of Man, rare (Hincks).

Genus *Membraniporella* (part), Smitt.

Syn. *Lepralia* (part), Johnst. and Gray, Busk., &c.
Membranipora (part), Smitt.
Berenicea (part), Fleming.

Two British species. *M. melolontha* has not been observed in our area. It is found on shells, oysters mostly, at the mouths of rivers, as the Thames, Orwell, etc.

Membraniporella nitida, Johnston.

Lepralia nitida, Johnst., Couch., Busk, Hincks, Smitt.
Escharoides nitida, M. Edw.

Isle of Man (E. Forbes); on *Pecten*, off Spanish Head, Isle of Man (twenty fathoms), dredged by Prof. Herdman.

Family XI.—Microporellidæ.

Syn. *Celleporidæ* (part), Johnst.
Membraniporidæ (part), Busk.
Porinidæ (part), d'Orbigny.
Eschariporidæ (part), Smitt

Genus *Microporella*, Hincks.

Syn. *Porina*, Smitt
Escharina (part), Gray, M. Edwards.

All the four British species are found in our area.

Microporella ciliata, Pallas.

Lepralia personata, Busk.
Lepralia ciliata, Johnst, Busk.
Porina ciliata, Smitt.

Isle of Man (Hincks).

Microporella malusii, Audouin.

Herentia biforis, Gray.
Lepralia malusii, Busk, &c.
Porina malusii, Smitt.

Isle of Man (Hincks). Dredged off Spanish Head (Isle of Man), on *Pecten* (twenty fathoms), by Prof. Herdman.

Microporella impressa, Audouin.

Flustra impressa, Aud., Sav
Lepralia granifera, Johnst., Busk.

Isle of Man (Hincks).

Microporella violacea, Johnston.

Lepralia violacea, Johnst, Busk, &c.
Porina violacea, Smitt.

Isle of Man (E. Forbes).

Genus *Chorizopora*, Hincks.

Syn. *Flustra* (sp.), Audouin.
Lepralia (sp.), Johnst, Busk.

Only one British representative.

Chorizopora brongniartii, Audouin.

Lepralia brongniartii, Busk.

Isle of Man (Hincks).

Family XII.—Porinidae.

Not found in Liverpool Bay.

Family XIII.—Myriozoidæ.

Syn. *Celleporidæ* (part), Johnst.
Membraniporidæ, Busk.

Genus *Schizoporella*, Hincks.

Syn. *Lepralia* (part), Johnston, Busk, &c.

This genus has eighteen British species.

Schizoporella spinifera, Johnst.

Lepralia ciliata, Hass. and Couch.
Lepralia spinifera, Johnst., Busk (in part).

Llandudno (Hincks), and Isle of Man, off Port Erin, dredged by Prof. Herdman (ten to fifteen fathoms).

Schizoporella auriculata, Hassall.

Lepralia auriculata, Hass., Johnst, Busk.
Escharella auriculata, Smitt.

Isle of Man (Hincks).

Schizoporella hyalina, Linnæus.

Cellepora hyalina, Linn., Fabr.
Lepralia hyalina, W. Thomp., Johnst, Busk
Mollia hyalina, Smitt.

Found in considerable abundance in the Isle of Man on *Laminaria* (Hincks). Also on the telson of *Homarus vulgaris* brought into Liverpool market (Lomas).

Schizoporella linearis, Hassall.

Lepralia linearis, Hass., Johnst, Busk, Norman, &c.
Lepralia hastata, Hincks, *Dev. and Corn. Cat*
Herentia linearis, Gray.
Escharella linearis, Smitt.

Very abundant and generally distributed (Hincks). Colwyn Bay (Shrubsole).

Genus *Hippothoa*, Lamouroux.

Syn. *Catenicella* (part), Blainville.
Mollia (part), Smitt.

Contains three British species and one doubtful one, *H. cassiterides*, Couch.

Hippothoa distans, MacGillivray.

Hippothoa flagellum, Manzoni, Hincks.

Isle of Man.

In Hincks' *British Marine Polyzoa* (1880), this is described as *H. flagellum*; but in *A. M. N. H.* for July, 1881, the name is withdrawn in favour of the above.

Hippothoa divaricata, Lamouroux.

Mollia hyalina forma divaricata, Smitt.

Generally distributed (Hincks). Colwyn Bay (Shrubsole).

Family XIV.—Escharidæ.

Syn. *Celleporidæ* (part), Johnst.
Escharidæ (part), Busk.
Membraniporidæ (part), Busk.

Genus *Lepralia*, Johnston (part).

Syn. *Eschara* (part), Auctt.

Contains eight British species.

Lepralia pallasiana, Moll.

Cellepora pallasiana, Lamx.
Lepralia pediostoma, Johnst.

Llandudno; Isle of Man, common (Hincks).

Lepralia foliacea, Ellis and Solander.

Eschara retiformis, Ray, d'Orb.
Stony foliaceous coralline, Ellis.
Millepora foliacea, Ellis and Sol.

Isle of Man (Dr. Brown); Holyhead (Higgin).

Lepralia pertusa, Esper.

Cellepora pertusa, Esper.
Cellepora perlacea, W. Thomp.
Escharella pertusa, Smitt.

Isle of Man (E. Forbes).

Genus *Umbonula*, Hincks.

Syn *Lepralia* (part), Johnst.
Discopora (part), Gray.
Eschara (part), Smitt.

Only one British species.

Umbonula verrucosa, Esper.

Cellepora verrucosa, Esp.
Lepralia verrucosa, W. Thomp., Johnst, Busk, &c.

Dredged by Prof. Herdman off Port St. Mary (Isle of

Man), also found on wood near Spanish Head. Not previously recorded in this locality.

Genus *Porella*, Gray.

Syn. *Cellepora* (part), Fleming.
Eschara (part), Sars., Busk, Alder, Smitt, &c.
Hemeschara (part), Norman, &c.

Contains five British species.

Porella concinna, Busk.

Lepralia concinna, Busk, Hincks.
Porella lævis, Smitt.
Lepralia belli, Dawson.

Isle of Man (Hincks).

Porella compressa, Sowerby.

Millepora compressa, Sow.
Cellepora cervicornis, Flem., Johnst., Couch, Busk, Alder.
Eschara cervicornis, Busk, Hincks, Smitt, &c.

Dredged off Spanish Head, 20 fathoms, by Professor Herdman. Very fine specimen, not previously recorded.

Genus *Smittia*, Hincks.

Syn. *Eschara* (part), Auctt.
Lepralia (part), Johnst., Busk, &c.

Seven British species.

Smittia landsborovii, Johnston.

Lepralia Landsborovii, Johnst., Busk, Hincks.
Eschara Landsborovii, Alder.
Lepralia crystallina, Norman.

Found off the Great Orme's Head (erect form) (Hincks), and on a piece of wood from the Isle of Man.

Smittia reticulata, Macgillivray.

Lepralia reticula, Macgill., Johnst., Busk, &c.

Dredged by Prof. Herdman off Spanish Head, Isle of Man (twenty fathoms), on *Pecten*. Not previously recorded in this district.

Smittia trispinosa, Johnston.

Discopora trispinosa, Johnst.
Lepralia trispinosa, Johnst., Busk, Hincks.
Escharella jacotini, Smitt.

Isle of Man (Hincks).

Genus *Phylactella*, Hincks.

Syn. *Lepralia* (part), auctt.
Alysidota (sp.), Busk.

Three British species.

Phylactella collaris, Norman.

Lepralia collaris, Norman.

Isle of Man (Hincks.

Genus *Mucronella*, Hincks.

Syn. *Lepralia* (part), Johnst., Busk, &c.
Escharella, Gray.
Discopora, Smitt.

Eight British species.

Mucronella peachii, Johnston.

Lepralia peachii, Johnst, Gray, Busk.
Escharella immersa, Grey.

Dredged off Spanish Head (Isle of Man), on *Pecten*, by Prof. Herdman. Not previously recorded in this district.

Mucronella variolosa, Johnston.

Lepralia variolosa, Johnst., Couch, Busk.

Found encrusting *Mytilus edulis* at Ramsey, Isle of Man. Not previously recorded.

Mucronella coccinea, Abildgaard.

Cellepora coccinea, Abildgaard.
Lepralia coccinea, Johnst., Busk.
Lepralia mamillata, Searles Wood, Busk, Manzoni.

Dredged by Prof. Herdman off Spanish Head, on *Pecten*, and off Port St. Mary, on *Laminaria* roots. Also found on *Anomia* (five fathoms). Very common in the Isle of Man.

Family XV.—Celleporidæ.

Syn. *Escharidæ* (part), d'Orb.
Myriozoidæ (part), Smitt.

Genus *Cellepora* (part), Fabricius.

Syn. *Tubipora* (part), Linn.
Millepora, Ellis and Sol.
Madrepora (part), Esper.

Seven British species.

Cellepora pumicosa, Linnæus.

Porous Eschara, Ellis.

Common; very large and beautiful specimens are found encrusting shells, sea-weeds, &c., in the Isle of Man, Ramsey, West Kirby, Hilbre (Lomas); Holyhead (Higgin).

Welshman's Gut, "Spindrift" Expedition.

Cellepora costazii, Audouin.

Cellepora bimucronata, Hass.
Cellepora hassallii, Busk, Manzoni.
Celleporaria hassallii, Smitt.

Isle of Man, Ramsey, and Point of Ayr (Hincks).

Dredged in the deep hole off the Point of Ayr (N. Wales), in the "Spindrift" Expedition.

Sub-order II.—CYCLOSTOMATA, Busk.

Syn. *Tubuliporina*. Milne-Edwards, Johnston.

Group *a*.—Radicellata, d'Orbigny.

Syn. *Articulata s. radicata*, Busk (1859), *Crag Polyzoa*.

Family I.—Crisiidæ.

Genus *Crisia* (part), Lamouroux.

Syn. *Sertularia* (part). Linn.

Three British species, all found in our area.

Crisia cornuta, Linn.

Crisidia cornuta, M. Ed., Johnst., Busk.

Found almost everywhere in our area. Llandudno, Isle of Man (Hincks); West Kirby, var. *geniculata* (Lomas); Menai Straits (Pennington); Holyhead (Higgin).

Crisia eburnea, Linn.

Crisia aculeata, Hassall, Johnst.

Isle of Man. Dredged on *Pecten* off Spanish Head (ten to fifteen fathoms) by Prof. Herdman; Blackpool, Menai Straits (Pennington). Found in a deep hole off the Point of Ayr in the "Spindrift" Expedition. Colwyn Bay (Shrubsole); Holyhead (Higgin).

Crisia denticulata, Lamarck.

Cellaria denticulata, Lamk.
Crisia luxata, Flem., &c.

Very generally distributed (Hincks).
Isle of Man (Lomas); Leasowe (Higgins).

Group *b*. Incrustata, d'Orbigny.

Syn. *Inarticulata*, Busk.

Family II.—Tubuliporidæ.

Genus *Stomatopora*.

Contains twelve British species.

Stomatopora expansa, Hincks.

Found on dead shells in the Isle of Man (Hincks). Not recorded in any other locality.

Stomatopora major, Johnston.

Alecto repens, Wood, Busk.
Alecto major, Johnst., Busk.

Isle of Man, in deep water (Hincks).

Genus *Tubulipora*, Lamarck.

Three British species.

Tubulipora lobulata, Hassall.

Extremely abundant off Maughold Head, Isle of Man (Hincks).

Ramsey Bay, on *Mytilus* (Lomas).

Tubulipora flabellaris, Fabricius.

Tubipora flabellaris, Fabr.
Tubulipora phalangea, Couch, Johnst., Hincks, Busk.

Colwyn Bay (Shrubsole). Not previously recorded in our district.

Genus *Idmonea*, Lamouroux.

Syn. *Tubulipora*, Lamk
Tubulipora, subgenus *Idmonea*, Smitt.

Two British species.

Idmonea serpens, Linn.

Tubipora serpens, Linn., &c.
Millepora tubulosa, Ellis and Sol.
Tubulipora serpens, Flem., Johnst., Busk, &c.

Generally distributed. Extremely abundant on the shore at West Kirby, on *Hydrallmania falcata* (Lomas). The specimens were collected from among the masses of sea weed left by the tide at high water mark, and they differ considerably from those forms which are found on shells and stones, &c. This species affords a good example of the changes which a form may undergo when placed under varying influences. The same form also dredged in the Welshman's Gut (seven fathoms), and Hilbre Swash, "Merry Andrew" expedition (ten to eleven fathoms). Seacombe (Byerley). Colwyn Bay (Walker); Holyhead (Higgin).

Genus *Diastopora*, Lamouroux.

Syn. *Tubulipora* (sp.) Johnst., &c.
Patinella (sp.) Busk, Hincks.

Four British species.

Diastopora patina, Lamarck.

Tubulipora patina, Lamk., Johnst.
Patinella patina, Busk.

Found on *Pecten* dredged by Prof. Herdman off Spanish Head, Isle of Man (twenty fathoms). Holyhead (Higgin).

Also found by Mrs. Beever.

Diastopora suborbicularis.

Diastopora simplex, Busk, *Cray Pol.*; Smitt.
Diastopora obelia, Johnst.

Found in Isle of Man (Hincks).

Diastopora obelia, Johnst.

Tubulipora obelia, Johnst.

Generally distributed on our coasts (Hincks). Rhyl (Shrubsole). Anglesea, fourteen fathoms (Forbes).

Family III.—Horneridæ.

Not represented in our area.

Family IV.—Lichenoporidæ.

Genus *Lichenopora*, Defrance.

Syn. *Discoporella.* Gray, Busk, Smitt.
Tubulipora (part), Johnst.
Heteroporella (sp.) Hincks.

Four British species.

Lichenopora hispida, Fleming.

Tubulipora hispida, Johnst.
Discoporella hispida, Gray, Busk, Smitt, Sars., Alder, &c.

Found in the Isle of Man (Hincks). Dredged by Prof. Herdman off Spanish Head (twenty fathoms) on *Pecten.*

Lichenopora verrucaria, Fabricius.

Madrepora verrucaria, Fabr., Linn.
Discoporella verrucaria, Smitt., Busk.

Rhyl (Shrubsole). This is a northern form, and it has not been recorded so far south before.

Sub-order III.—CTENOSTOMATA, Busk.

Syn. *Halcyonellea* and *Vesicularina*, Johnston.

Group *a*. Halcyonellea, Ehrenberg.

Syn. *Alcyonidulæ*, Johnst., *Brit. Zooph.*, edit. 1.
Polyzoa carnosa, Gray.

Family I.—Alcyonidiidæ.

Syn. *Alcyonidulæ*, Couch.
Halcyonelleæ, Smitt.

Genus *Alcyonidium*, Lamouroux.

Syn. *Alcyonium* (part), Linn, Pallas, &c.
Cycloum, (sp.), Hassall.

Nine British species.

Alcyonidium gelatinosum, Linnæus.

Sea ragged staff, Ellis.
Alcyonium gelatinosum, Linn., Pallas, Ellis and Sol., Lamx., &c.

This species is very abundant in our district, and grows to an enormous size.

Isle of Man and Llandudno (Hincks). Dredged in the "Hyena" Expedition in the Menai Straits opposite Bangor, and in a deep hole off the Point of Air in the "Spindrift" Expedition. Hilbre (Marrat).

Alcyonidium hirsutum, Fleming.

Alcyonium hirsutum, Flem.
Cycloum papillosum, Hassall, Johnst., Byerley, &c.

Isle of Man, Llandudno, Menai Straits (Hincks). Dredged off Port Erin (ten to fifteen fathoms) by Prof. Herdman, and by Mr. Thompson off Penmaenmawr.

Alcyonidium mytili, Dalyell.

Syn. *Alcyonidium hexagonum*, Hincks, Alder
Alcyonidium parasiticum, Smitt.

Llandudno. Isle of Man, common. Menai Straits (Hincks).

Alcyonidium parasiticum, Fleming.

Alcyonium parasiticum, Flem., Blainv.

Menai Straits (Hincks). Liverpool Bay (Higgins). North Wales (Shrubsole).

Family II.—Flustrellidæ.

Syn. *Halcyonelleæ* (part), Smitt.

Genus *Flustrella*, Gray.

Syn. *Flustra* (part), Flem., Blainv., Johnst., Couch., Hincks, &c.
Alcyonidium (part), Smitt.

Only one British species.

Flustrella hispida, Fabricius.

Flustra hispida, Fabr., Flem., &c.
Alcyonidium hispidum, Johnst., Smitt, &c.
Cycloum hispidum, W. Thomp.

Common and widely distributed.

Dredged in the summer by Mr. Thompson off Penmaenmawr. Colwyn Bay (Shrubsole); Hilbre, Isle of Man, &c.

Family III.—Arachnidiidæ.

Syn. *Alcyonidiadæ* (part), Hincks, 1862; Alder.

Genus *Arachnidium*, Hincks.

Syn. *Arachnidia*, Hincks, Alder.

This Genus contains three British forms.

Arachnidium hippothooides, Hincks.

Arachnidia hippothooides, Hincks.

On a *Cyprina*, dredged off the Isle of Man (Hincks).

Only one other locality, Torbay, is known where this form occurs.

Group *b*. **Stolonifera**, Ehlers.

Syn. *Vesicularina*. Johnst.

Section I.—*Orthonemida*, Hincks.

Family IV.—Vesiculariidæ.

Genus *Vesicularia* (part). J. V. Thompson.

Syn. *Sertularia*, Linn, Pallas, &c
Valkeria, Flem., &c.

Only contains one British species.

Vesicularia spinosa, Linnæus.

Silk coralline, Ellis.
Sertularia spinosa, Linn., Ellis and Sol., Lamk.

This species is very common in our area.

Menai Straits, Llandudno, Lytham, Isle of Man (Hincks). Liverpool (Landsborough). Blackpool (Pennington). Hilbre and New Brighton (Marrat). Colwyn Bay (Walker).

Dredged in large quantities in fourteen fathoms about six miles from Great Orme's Head, in the "Hyæna" expedition.

Genus *Amathia*, Lamouroux.

Syn. *Sertularia* (part), Linn, &c.
Serialaria, Lamk. (1816), Flem., Johnst., &c.

Only one British species.

Amathia lendigera, Linnæus.

Nit coralline, Ellis.
Sertularia lendigera, Linn., Pall., &c.
Serialaria lendigera, Lamk., Johnst., Couch, Landsb., Alder, &c.

Very common.

Llandudno, Menai Straits, Isle of Man (Hincks); Penmaenmawr, dredged by Mr. Thompson; Blackpool (Pennington); West Kirby, on shore (Lomas); Puffin Island and Hilbre Island (Marrat); Beaumaris (Walker); Anglesea (Forbes); Holyhead (Higgin).

Dredged in Hilbre Swash, "Merry Andrew" Expedition (ten to eleven fathoms), and in the hole off Point of Air, "Spindrift" Expedition.

Genus *Bowerbankia*, Farre.

Syn. *Valkeria* (part), Johnst., Hassall, Couch.

Contains five British species.

Bowerbankia imbricata, Adams.

Sertularia imbricata, Adams, Thomp.
Valkeria imbricata, Johnst., Couch.

Very common. Dredged off Port Erin, by Professor Herdman (ten to fifteen fathoms). Hilbre Island (Lomas). Menai Straits (Pennington).

Bowerbankia pustulosa, Ellis and Sol.

Dichotomous tubular coralline, Ell.
Sertularia pustulosa, Ellis and Sol.
Vesicularia pustulosa, J. V. Thomps.
Valkeria pustulosa, Johnst.

Menai Straits. Llandudno (Hincks). Isle of Man, dredged by Professor Herdman.

Genus *Farrella*, Ehrenberg.

Syn. *Lagenella*, Farre, W. Thompson, Hassall.
Laguncula, Van Ben.

Only has one British representative.

Farrella repens, Farre.

Lagenella repens, Farre, W. Thomp.
Bowerbankia repens, Johnst.
Farrella producta, Hincks.

There are two varieties of this species, *repens* and *elongata*.

In the *British Marine Polyzoa*, p. 530, Hincks says :— "As to the distribution of the species, it is somewhat peculiar that the *elongata* form, which is too remarkable readily to escape observation, has only been noticed on certain portions of the Lancashire coast, where it occurs in amazing profusion, investing all kinds of marine substances."

Form *elongata*. Fleetwood, on a buoy; Lytham, extremely abundant (Hincks).

Family V.—Buskiidæ.

Syn. *Vesicularidæ* Alder.

Genus *Buskia*, Alder.

Only one British species.

Buskia nitens, Alder.
Llandudno (Hincks).

Family VI.—Cylindrœciidæ.

Syn. *Vesiculariadæ* part), Busk, Alder, Hincks.

Genus *Cylindrœcium*, Hincks.

Syn. *Farrella* (part), Busk, Gosse, Hincks.
Avenella, Alder, Hincks, Gosse.

Contains three British species.

Cylindrœcium dilatatum, Hincks.

Farrella dilatata, Hincks.
Farrella fusca, Busk.

Llandudno; Isle of Man (Hincks).
Dredged off Port Erin (ten to fifteen fathoms) by Prof. Herdman.

Genus *Anguinella*, Van Beneden.

Only one British species.

Anguinella palmata, Van Beneden.
Hilbre Island (Herdman).

Family VII.—Triticellidæ.

Not yet found in our district.

Section II.—*Campylonemida*, Hincks.

Family VIII.—Valkeriidæ.

Syn. *Vesiculariadæ* (part), Johnst., Alder.

Genus *Valkeria* (part), Fleming.

Syn. *Sertularia* (part), Linn., Pallas, &c.
Vesicularia (part), J. V. Thompson, Smitt.
Campylonema, Hincks.

Contains two British species.

Valkeria uva, Linnæus.

Repent form. Grape Coraline. Ellis.
Sertularia uva, Linn., Ellis and Sol.
Erect form. Climbing dodder-like Coralline, Ellis.
Sertularia cuscuta, Linn., Pall., Lamx, &c.

Form *uva*. Menai Straits, on larger *Fuci*, in immense quantity (Hincks).

Form *cuscuta*. Landudno. Menai Straits, on larger *Fuci* (Hincks). Isle of Man, dredged by Professor Herdman.

Valkeria tremula, Hincks.
Campylonema tremulum, Hincks.
Dredged off the Isle of Man (Hincks).

Family IX.—Mimosellidæ.

Genus *Mimosella*, Hincks.

Only one British representative.

Mimosella gracilis, Hincks.
Valkeria cuscuta, Couch.

Dredged by Prof. Herdman off the Isle of Man, between Port Erin and the Calf (ten to fifteen fathoms). Not previously recorded.

Family X.—Victorellidæ, Saville Kent.

Not found in our area. This family only contains one species, *Victorella pavida*, a brackish and fresh water form, which has been found in the Victoria Docks, London, and

recently in the Regent's Canal by Mr. Bousfield. Probably a good search in our estuary and docks might lead to its discovery.

Sub-class II.—Entoprocta, Nitsche.

Order.—PEDICELLINEA.

The only order.

Family I.—PEDICELLINIDÆ.

Syn. *Pedicellinæ*, Johnston.

Genus *Pedicellina, Sars.*

Syn. *Hydra* (part), Bosc, Blainville.

Contains three British representatives.

Pedicellina cernua, Pallas.

"Fleshy Polypes of a red colour and a particular kind." Ellis.

Pedicellina echinata, Sars., Hassall, Smitt, &c.

Pedicellina belgica, Gosse, Hincks.

Both the smooth and spinose varieties of this species are common in the Isle of Man (Lomas).

Pedicellina gracilis, Sars.

Isle of Man; Fleetwood, on a buoy; Llandudno (Hincks).

Dredged by Prof. Herdman between Port Erin and the Calf (ten to fifteen fathoms).

Var. *nodosa*, nov. (Pl. III, fig. 2).

Among the material dredged in the Isle of Man, I found the form which Hincks describes as having the stem "very much elongated, and consists of several sections separated by knots or swellings, which are also muscular in character." At first I thought it was *P. belgica*, Van Beneden, which is characterised by a swelling in the stem, but on separating the stolon from the sea weed on which it was growing, I discovered that on the same stolon there was the ordinary form without the medial swelling. The swelling in *P. belgica*, moreover, is gradual, while in this form it is abrupt and sharply defined from the rest of the stem.

The stems are arranged alternately, with great regularity on opposite sides of the stolon. There is a swelling at the junction of the stolon with the stem-basal cylinder of Hincks, which, in this case, is wider than in the one figured in B. M. P., and the muscular substance is continued for a little distance on each side into the stolon. Then about the middle of the stem is another swelling, and just under the head a third, which is constricted so as to have the appearance of two swellings, both muscular, and the lower one rather less than the upper one. It is easy to see that these swellings would be of great use to the creature in giving it a variety of movements in order to search for food and to retreat in face of danger.

It is possible that the individual without the medial swelling may be an imperfectly developed form so far as the stem is concerned. How the median swelling has been formed I do not know, but it is quite possible that the head swelling may be converted into the median one by an elongation of the stem above it. I am the more inclined to this view since, in some individuals, there is a short stem between the uppermost swelling and the head, and the part of the stem above the median swelling varies much in size, while the part between the base and middle swelling is pretty constant (Pl. III, fig 2).

There is little doubt, I think, that it should be referred to *P. gracilis*, yet the characters mentioned above show it to be a well marked and very aberrent variety, for which I propose the name, var. *nodosa*.

Family II.—Loxosomidæ.

Not recorded in our area.

Explanation of Plate III.

Fig. 1. *Eucratea chelata*, var. *elongata*, nov.

Fig. 2. *Pedicellina gracilis*, var. *nodosa*, nov.

TABLE SHOWING DISTRIBUTION OF THE SPECIES IN THE DISTRICT.

Page in Report.	Species.	Cheshire Coast and Hilbre Island.	Welsh Coast, Rhyl to Penmaenmawr.	Menai Straits and Anglesey.	Lancashire Coast, Liverpool to Fleetwood.	Isle of Man.	Remarks.
163	Sub-Order I.—CHEILOSTOMATA.						
163	Family I.—AETEIDÆ.						
163	*Aetea.* Lamx.						
164	*anguina.* Linn.	+	+	+		+	
164	*recta.* Hincks					+	
164	*truncata.* Landsb.					+	
164	Family II.—EUCRATIIDÆ.						
164	*Eucratea.* Lamx.						
164	*chelata.* Linn.		+	+		+	
164	*α repens*					+	
165	*β gracilis*					+	
165	*γ elongata*					+	
165	*Gemellaria.* Sav.						
165	*loricata.* Linn.	+	+	+	+		
165	Family III.—CELLULARIIDÆ.						
166	*Cellularia.* Pallas						
166	*peachii.* Busk	+					

166	*Scrupocellaria.* Van Ben.	.	.	.	+	.	.	.	+	.
166	*scruposa.* Linn.	.	+	+	.	.	.	.	+	.
166	*scrupea.* Busk	.	+	+	.	.	.	.	+	.
166	*reptans.* Linn.	.	+	+	+	.	.	.	+	.
166	Family IV.—Bicellariidæ.									
167	*Bicellaria.* Blainville	.	.	.	.	.	.	.	.	.
167	*ciliata.* Linn. .	.	+	+	+	+	.	.	.	.
167	*Bugula.* Oken .	.	.	.	.	.	.	.	.	.
167	*turbinata.* Alder	.	+	+	+	.	.	.	+	.
167	*flabellata.* J. V. Thomp.	.	+	+	+	+	.	.	+	.
168	*avicularia.* Linn.	.	.	+	+	+	.	.	.	.
168	*plumosa.* Pallas	.	+	+	+	+	.	.	+	.
168	*purpurotincta.* Norman	.	.	.	.	.	.	.	.	.
168	*Beania.* Johnston	.	.	.	+	.	.	.	.	.
168	*mirabilis.* Johns.	.	.	.	.	.	.	.	+	.
168	Family VI.—Cellariidæ.									
169	*Cellaria.* Lamx.	.	.	.	.	.	.	.	.	.
169	*fistulosa.* Linn.	.	.	+	+	.	.	.	+	.
169	Family VII.—Flustridæ.									
169	*Flustra.* Linn. .	.	.	.	.	.	.	.	.	.
170	*foliacea.* Linn.	.	+	+	+	+	.	.	+	.
170	*carbasea.* Ellis and Sol.	.	.	.	.	+	.	.	.	.
170	*securifrons.* Pall.	.	.	+	.	.	.	.	.	.
170	*papyracea.* Ellis and Sol.	.	+	.	.	.	.	.	.	.

TABLE SHOWING DISTRIBUTION OF THE SPECIES IN THE DISTRICT—*cont.*

Page in Report.	Species.	Cheshire Coast and Hilbre Island.	Welsh Coast, Rhyl to Penmaenmawr.	Menai Straits and Anglesey.	Lancashire Coast, Liverpool to Fleetwood.	Isle of Man.	Remarks.
170	Family VIII.—MEMBRANIPORIDÆ.						
170	*Membranipora.* Blainville						
170	*lacroixii.* Aud.	+	+		+	+	
171	*monostachys.* Busk						On Lobster, brought into Liverpool market, locality doubtful.
171	*catenularia.* Jameson					+	
171	*pilosa.* Linn.	+	+	+	+	+	
172	*flemingii.* Busk.					+	
171	*hexagona.* Busk					+	
172	*lineata.* Linn.					+	
172	*craticula.* Alder					+	
172	*spinifera.* Johns.					+	
172	*dumerilii.* Aud.					+	
172	*rosselii.* Aud.					+	
172	*aurita.* Hincks.					+	
171	*membranacea.* Linn.	+	+			+	
172	Family IX.—MICROPORIDÆ.						
173	*Micropora.* Gray						
173	*coriacea.* Esper					+	

173	Family X.—Cribrilinidæ.					
173	*Cribrilina.* Gray.					
173	*radiata.* Moll.					+
173	*punctata.* Hass.					+
173	*annulata.* Fabr.					+
174	*Membraniporella.* Smitt					
174	*nitida.* Johns.					+
174	Family XI.—Microporellidæ.					
174	*Microporella.* Hincks					
174	*ciliata.* Pallas					+
174	*malusii.* Aud.					+
175	*impressa.* Aud.					+
175	*violacea.* Johns.					+
175	*Chorizopora.* Hincks					
175	*brongniartii.* Aud.					+
175	Family XIII.—Myriozoidæ.					
175	*Schizoporella.* Hincks					
176	*linearis.* Hass.		+			
175	*spinifera.* Johns.		+			+
176	*auriculata.* Hassall					+
176	*hyalina.* Linn.			+		+
176	*Hippothoa.* Lamx.					
176	*distans.* McGill			+		+
176	*divaricata.* Lamx.			+		

TABLE SHOWING DISTRIBUTION OF THE SPECIES IN THE DISTRICT—*cont.*

Page in Report.	Species.	Cheshire Coast and Hilbre Island.	Welsh Coast, Rhyl to Penmaenmawr.	Menai Straits and Anglesey.	Lancashire Coast, Liverpool to Fleetwood.	Isle of Man.	Remarks.
177	Family XIV.—ESCHARIDÆ.						
177	*Lepralia.* Johns.						
177	*pallasiana.* Moll.		+			+	
177	*foliacea.* Ellis and Sol.			+		+	
177	*pertusa.* Esper					+	
177	*Umbonula.* Hincks.						
177	*verrucosa.* Esper					+	
178	*Porella.* Gray						
178	*concinna.* Busk					+	
178	*compressa.* Sow.					+	
178	*Smittia.* Hincks						
178	*landsborovii.* Johns.		+			+	
178	*reticulata.* McGill					+	
179	*trispinosa.* Johns.					+	
179	*Phylactella.* Hincks						
179	*collaris.* Norman					+	
179	*Mucronella.* Hincks						
179	*peachii.* Johns.					+	
179	*variolosa.* Johns.					+	
179	*coccinea.* Abild.					+	

180	**Family XV.—Celleporidæ.**						
180	*Cellepora.* Fab. . . .						
180	*pumicosa.* Linn. . .	+	+	+	+	+	
180	*costazii.* Aud. . .		+			+	
180	**Sub-Order CYCLOSTOMATA.**						
180	**Family I.—Crisiidæ.**						
180	*Crisia.* Lamx. . . .						
181	*cornuta.* Linn. . .	+	+	+	+	+	
181	var. *geniculata* . .		+			+	
181	*eburnea.* Linn. . .	+	+	+	+	+	
181	*denticulata.* Lamk. .	+				+	
181	**Family II.—Tubuliporidæ.**						
181	*Stomatopora.* Bronn. . .						
181	*expansa.* Hincks . .					+	
181	*major.* Johns. . .					+	
181	*Tubulipora.* Lamk. . .						
182	*lobulata.* Hass. . .					+	
182	*flabellaris.* Fabr. . .		+				
182	*Idmonea.* Lamx. . .						
182	*serpens.* Linn. . .	+	+	+		+	
182	*Diastopora.* Lamx. . .						
183	*patina.* Lamk. . .		+	+		+	
183	*suborbicularis.* Hincks .					+	
183	*obelia.* Johnst. . .		+	+			

TABLE SHOWING DISTRIBUTION OF THE SPECIES IN THE DISTRICT—*cont.*

Page in Report.	Species.	Cheshire Coast and Hilbre Island.	Welsh Coast, Rhyl to Penmaenmawr.	Menai Straits and Anglesey.	Lancashire Coast, Liverpool to Fleetwood.	Isle of Man.	Remarks.
183	Family IV.—LICHENOPORIDÆ.						
183	*Lichenopora.* Defrance						
183	*hispida.* Flem.						
183	*verrucaria.* Fabr.		+			+	
184	Sub-Order III.—**CTENOSTOMATA.**						
184	Family I.—ALCYONIDIIDÆ.						
184	*Alcyonidium.* Lamx.						
184	*gelatinosum.* Linn.	+	+	+		+	
184	*hirsutum.* Flem.	+	+	+		+	
184	*mytili.* Dal.		+	+		+	
185	*parasiticum.* Flem.	+	+	+			
185	Family II.—FLUSTRELLIDÆ.						
185	*Flustrella.* Gray						
185	*hispida.* Fabr.	+	+	+		+	
185	Family III.—ARACHNIDIIDÆ.						
185	*Arachnidium.* Hincks						
185	*hippothooides.* Hincks					+	

186	**Family IV.—Vesiculariidæ.**						
186	*Vesicularia.* J. V. Thomp.						
186	*spinosa.* Linn.	+	+	+	+	+	
186	*Amathia.* Lamx.						
186	*lendigera.* Linn.	+	+	+	+	+	
187	*Bowerbankia.* Farre						
187	*imbricata.* Adams	+	+	+		+	
187	*pustulosa.* Ellis & Sol.		+	+		+	
187	*Farella.* Ehrenberg						
187	*repens.* Farre						
187	var. *elongata*				+		
188	**Family V.—Buskiidæ.**						
188	*Buskia.* Alder						
188	*nitens.* Alder		+				
188	Family VI.—Cylindrœciidæ.						
188	*Cylindrœcium.* Hincks						
188	*dilatatum.* Hincks		+			+	
188	*Anguinella.* Van Ben.						
188	*palmata.* Van Ben.	+					
189	**Family VIII.—Valkeriidæ.**						
189	*Valkeria.* Flem.						
189	*uva.* Linn.						
189	form *uva*			+			
189	form *cuscata*		+	+		+	
189	*tremula.* Hincks					+	

TABLE SHOWING DISTRIBUTION OF THE SPECIES IN THE DISTRICT—*cont.*

Page in Report.	Species.	Cheshire Coast and Hilbre Island.	Welsh Coast, Rhyl to Penmaenmawr.	Menai Straits and Anglesey.	Lancashire Coast, Liverpool to Fleetwood.	Isle of Man.	Remarks.
189	Family IX.—MIMOSELLIDÆ.						
189	*Mimosella*. Hincks . .						
189	*gracilis*. Hincks . .					+	
190	Sub-Class ENTOPROCTA.						
190	Family I.—PEDICELLINIDÆ.						
190	*Pedicellina*. Sars. . .						
190	*cernua*. Pall. . . .					+	
190	*gracilis*. Sars. . .		+		+	+	
190	var. *nodosa* . . .					+	

REPORT on the COPEPODA of the L. M. B. C. DISTRICT.

By Isaac C. Thompson, F.R.M.S.

The Copepoda reported upon were collected during the summer of 1885, between May and August inclusive. Many of them were captured during the cruise of the "Hyæna" and on the second Hilbre expedition, and a large number later in the season, off Port Erin, at the south end of the Isle of Man.

It is a remarkable fact that with special opportunities for dredging and tow-netting off Penmaenmawr during July, scarcely any Copepoda were found. Their absence at that time may probably be accounted for by the wide-spread diffusion throughout the sea of the minute gelatinous spherical bodies referred to in the *Report on the Fauna of Penmaenmawr.**

In this connection it is interesting to find that Mr. Pearcey observed, † while conducting tow-netting investigations in the Shetland Seas in the summer of 1884, that in regions where the diatom *Rhizosolenia shrubsolei* was present in great abundance animal life was almost entirely absent in the surface waters.

The strained material from water containing the specimens captured by the tow-net was treated in two different ways for preservation. Firstly, by hardening with a saturated solution of Picric Acid and then with Alcohol; and, secondly, by preserving in a mixture of Glycerine, Alcohol and Water. The former method, though admirable as a preservative of the

* See further on in this Volume.

† "Movements and Food of the Herring," &c., *Proc. Roy. Physical Soc, Edin.*, vol. viii, p. 389, 1885.

tissues, has the disadvantage of destroying any natural colours the animal may have, and it also appears to render the specimens somewhat brittle. Glycerine, besides possessing most valuable preservative qualities itself, has the happy advantage of mixing in any proportion with both alcohol and water, and it has been found that a solution composed as follows—Water 1 part, Proof Spirit 2 parts, and Glycerine 1 part, with 1 per cent. of Carbolic Acid added, is admirably adapted for preserving these small Crustaceans. Any tendency that the glycerine alone might have to dissolve out carbonate of lime is probably counteracted by the addition of the spirit and water.

From either the picric acid and alcohol solution (after washing), or from the glycerine mixture, the objects may without further preparation be at once mounted in Farrant's solution as permanent slides, by which their natural characteristics are maintained intact.

The collection of Copepoda includes nineteen species, of which thirteen are previously unrecorded as belonging to this locality. Three, at least, are altogether new to Britain, and one is possibly an addition to science.

The tow-netting observations made at Port Erin, at various times of the day and evening, do not seem to show any marked variation according to the time; the Copepoda being very much the same in gatherings taken in the middle of the day and after sundown.

My thanks are due to Dr. G. S. Brady, F.R.S., for having kindly examined and identified some of the more difficult specimens, and for additional information in regard to some of the species described in his Ray Society Monograph and "Challenger" Report.*

* A Monograph on the British Copepoda, Ray Society, 1878 and 1880. Report upon the Copepoda collected during the Voyage of H.M.S. 'Challenger,' *Zool. Chall. Exp.*, Part xxiii, 1883.

These works have been followed in the arrangement and nomenclature of the species.

Order COPEPODA.

Family I.—Calanidæ.

Calanus finmarchicus, Gunner.

Cetochilus septentrionalis, Goodsir, *Ed. New Phil. Journ.*, xxxv, p. 339, t. vi, figs. 1–11 (1843).

Cetochilus septentrionalis, Baird, *Nat. Hist. Brit. Entom.*, p. 235, t. xxx, figs. 1*a–g* (1850).

Quantities of this species were found in most of the tow-net gatherings taken by Prof. Herdman off Port Erin, at the south end of the Isle of Man, during August. This is probably the most abundant and most widely diffused of all the Copepoda, and it is somewhat singular that it does not occur in any of the tow-net gatherings taken off the Welsh coast or in the neighbourhood of Hilbre Island earlier in the season. It luxuriates in the open sea.

Pleuromma abdominale, Lubbock.

Pleuromma gracile, Claus.

One female Copepod taken in the tow-net off Port Erin, Isle of Man, in the evening, after sunset, appears to belong to this species, which has not hitherto been found in British seas. The specimen, after having been mounted as a microscope slide, was examined by Dr. Brady, and he has stated that he felt unable to name it positively without dissection, but that it seemed to be new to the British Fauna.

The specimen on a careful examination is found to agree in all essential points with the description and figures Brady gives * of an immature condition of *Pleuromma abdominale* undoubtedly identical with Claus' *Pleuromma gracile*.

* "Challenger" Report, p. 46.

Metridia armata, Boeck.

Paracalanus hibernicus, Brady and Robertson, *Annals and Mag. of Nat. Hist.*, ser. 4, vol. xii, p. 126, pl. viii, figs. 1–3 (1873).

Found sparingly in the gatherings taken off Port Erin, Isle of Man. All the specimens obtained were males.

Pseudocalanus elongatus, Boeck.

Clausia elongata, Boeck, *Oversigt Norges Copep.*, p. 10 (1864).

This species occurs in several of Professor Herdman's tow-net gatherings from Port Erin, Isle of Man.

Candace truncata (?), Dana.

A few specimens belonging to the genus *Candace* were found among Prof. Herdman's Port Erin gatherings, and were referred to *C. truncata*, a species new to Britain. The chief distinctive feature of the only known British species *C. pectinata* appears to be the presence in the male of a long spine at one side only of the last joint of the thorax; and as all the specimens examined are females, it is just possible they may be *C. pectinata*; they do not, however, exhibit the peculiar shape of abdomen figured by Brady as characteristic of the female of *C. pectinata*. Some more important characteristic by which the females of *C. pectinata* and *C. truncata* may be satisfactorily distinguished is much wanted.

Dias longiremis, Lilljeborg.

Calanus euchæta, Lubbock, *Ann. and Mag. Nat. Hist.*, ser. 2, vol. xx, p. 401, pl. x, figs. 1–6 (1857)

This strongly marked characteristic species was found plentifully in Prof. Herdman's Port Erin gatherings.

Temora longicornis, Müller.

Cyclops longicornis, Müller, *Entom.*, p. 115, t. xix, figs. 7–9 (1785).

Temora finmarchica, Baird, *Brit. Entom.*, p. 228, t. xxviii, figs. 1*a–g* (1850).

Multitudes of this species were taken in the tow-net near Puffin Island during the cruise of the "Hyæna." It also occurs plentifully among Prof. Herdman's Port Erin gatherings.

Centropages typicus, Kröyer.

Ichthyophorba denticornis, Claus, *Die frei-lebenden Copepoden*, p. 199, pl. xxxv, figs. 1, 3–9 (1863).

Ichthyophorba denticornis, Brady, *Nat. Hist. Trans. N.* and *D.*, vol. i, p. 40, pl. iv, figs. 1–6 (1864).

One specimen only of this species was found in the tow-net material collected in Hilbre Swash during the "Merry Andrew" expedition.

Centropages hamatus, Lilljeborg.

This common species was found abundantly during the cruise of the "Hyæna," off Puffin Island, as well as in Hilbre Swash, and in the Port Erin gatherings.

Brady refers to the "spines of the swimming feet differing remarkably from those of *Centropages typicus*, in having their serrated armature much stronger, and the teeth separated one from another by a wider interval"; but the specimens of the two species which I have examined seem very similar in this respect.

Anomalocera patersonii, Templeton (Pl. IV, fig. 2).

Irenæus patersonii, Goodsir, *Edin. New Phil. Journ.*, xxxv, p. 339, t. vi, figs. 12–17; t. iv, figs. 1–9 (1843).

Irenæus patersonii, Claus, *Die frei-lebenden Copepoden*, p. 206, taf. ii, fig. 1, t. xxxvii, fig. 1–6 (1863).

A few specimens of this most interesting species were taken during the cruise of the "Hyæna." It is remarkable for its various colours, many of which are still preserved after mounting in Farrant's solution.

Brady says he has "never been able to find the spine which is said by Dr. Claus to exist in the first segment

of the male abdomen;" it is, however, very well defined in one of the specimens taken off Puffin Island (see Pl. IV, fig 2).

Family III.—Cyclopidæ.

Oithona spinifrons, Boeck.

One female specimen of this species was found amongst Prof. Herdman's Port Erin material. It is a very minute species, and therefore difficult to dissect. Dr. Brady, who has examined the specimen, regards it as an *Oithona*, but considers it doubtful whether or not it really belongs to this, the only hitherto known British species. The specimen seems to me, however, to agree with the essential characters of *O. spinifrons* in all respects.

Family IV.—Notodelphyidæ.

Ascidicola rosea, Thorell.

Notodelphys ascidicola, Allman, *Ann. and Mag. Nat. Hist.*, vol. xx, pl. i, figs. 1–13 (1847).

One specimen of this parasitic species was found in the branchial sac of a Simple Ascidian dredged off the South end of the Isle of Man.

Family VI.—Harpacticidæ.

Canthocamptus stromii (?), Baird.

Byerley records this species as having been found by Mr. Weightman at New Brighton, in tide pools, 1853.

Canthocamptus furcatus.

Recorded by Mr. Byerley as found at Hilbre, and in pools amongst seaweed around the coast.

Harpacticus chelifer, Müller (Pl. IV, fig. 3).

Cyclops chelifer. O. F. Müller, *Zool. Dan. Prodr.*, 2413; *Entomostraca*, p. 114, taf. xix, figs. 1-3, 1776.

Recorded by Mr. Byerley as being "not uncommon upon

the shores of Wirral." Found in rock pools on Hilbre Island.

All the specimens of this species which I have examined were females bearing ovisacs; and the dorsal edge of the Cephalothorax was strongly spinose (see Pl. IV, fig. 3).

Peltidium depressum, Baird.

Alcathoa depressa. Baird. *Trans. Berwick Nat. Club*, ii. p. 155, 1845: *Nat. Hist. Brit. Entom.*, p. 216, tab. xxx, figs. 1–2 (1850).

Recorded by Byerley as "found occasionally in pools upon the shore."

Family IX.—Artotrogidæ.

Caligus rapax. Milne Edwards.

Recorded by Mr. Byerley as parasitic upon the Sapphirine Gurnard.

Caligus mülleri, Leach.

Recorded by Mr. Byerley as having been found attached in great numbers to a *Cyclopterus lumpus*, and on a very large Thornback.

Family.—Doubtful.

———— ————, new species (?).

A single specimen of a very curious female Copepod, with a remarkable constriction in the middle of the cephalothorax, was obtained in the townet, in the neighbourhood of Puffin Island, during the cruise of the "Hyæna." It is unlike any species which has previously been described, and Dr. Brady, to whom the specimen was submitted, states that he considers it a very remarkable form, but that he can say nothing positive in regard to it without dissection and careful examination.

Probably this form is new to science, but it is impossible

to decide the matter definitely, or to give a full description from the single specimen which is now mounted.

It will be interesting to see whether, during next summer's investigations by the Committee, any further specimens of this form are found in the same locality off Puffin Island.

Explanation of Plate IV.

[Fig. 1.—*Protella phasma*, Dana; young. See page 218.]

Fig. 2.—The spines on the right side of the last thoracic segment, and the first abdominal segment of the male *Anomalocera patersonii*.

Fig. 3.—*Harpacticus chelifer*, female, showing spinose back.

NOTES on the CIRRIPEDIA of the L. M. B. C. DISTRICT.

By F. P. Marrat, Free Public Museum.

What is known of the Cirripedes of this district is almost all contained in Byerley's *Fauna*. No satisfactory collection of the species enumerated is to be found either in our Public Museum or in any private collection. Under these circumstances, it is evident that if we wish to procure satisfactory evidence regarding our local species, the specimens must be re-examined and a collection formed. The specimens obtained by the dredging investigations of the Liverpool Marine Biology Committee have added *Chthamalus stellatus* and *Verruca strömia* to the list of species previously recorded.* I take this opportunity of correcting the nomenclature of Mr. Byerley's list.

THORACICA.

Family.—Balanidæ.

Balanus porcatus, Costa.

Balanus scoticus, Wood. = *Balanus eburneus*, Brown.

This is the *Balanus scoticus* of Byerley's list. I remember specimens of this species having been shown to me attached to *Modiola modiolus* which had been brought in by the Liverpool fishing boats.

Balanus hameri, Ascan.

Isle of Man and Anglesea, twelve fathoms (Darwin).

* Foreign species brought into the Mersey attached to ships have been omitted.

Balanus balanoides, Linn.

This is the very abundant small species of this neighbourhood.

Balanus perforatus, Brug.

Balanus communis, Pult.

Occasionally found upon *Buccinum* and other shells. Two specimens were dredged from fourteen fathoms, off Puffin Island, during the cruise of the "Hyæna."

Balanus crenatus, Brug.

Balanus rugosus, Pult.

Recorded by Byerley under the name of *B. rugosus* as "very abundant, attached to seaweed, shells, sea-walls, &c. Thickly set upon the Rock Lighthouse."

The *Balanus clavatus* of Byerley's list is probably only an elongated variety of *B. crenatus*. It is recorded as having being found "in the clefts of the wooden piles about piers," &c.

Chthamalus stellatus, Poli.

Very common in shore pools at Fleshwick Bay, Isle of Man.

Family.—Verrucidæ

Verruca strömia, O. F. Müller.

On *Laminaria*, Port Erin, Isle of Man.

Family.—Lepadidæ.

Lepas anatifera, Linn.

A few years ago a balk of timber was seen floating near the entrance to the Mersey, and was drifted into one of the northern docks. It had evidently been a long time in the water, and was literally covered with specimens of *Lepas anatifera*, ranging in size from about six inches or less to a foot or more in length. From the *Balani* attached to the

wood all being British species, I infer that the pedunculated Cirripedes had also become fastened, and had continued to grow, in some situation not far from the Liverpool district.

RHIZOCEPHALA.

Family.—Peltogastridæ.

Sacculina carcini, Thompson.

Common, attached to the abdomen of Crabs, in Hilbre Swash, &c.

LIST of the AMPHIPODA of the L. M. B. C. DISTRICT.

By G. Herbert Fowler, B.A., Oxon.,
berkeley fellow of the owens college, manchester.

The classification on which this list is based is that of Messrs. Spence-Bate and Westwood, in their *British Sessile-eyed Crustacea*.

The letter W signifies that species so marked were obtained and named by Mr. A. O. Walker, of Chester; while [N] and [S] mark species determined by the Rev. A. M. Norman and the Rev. T. R. R. Stebbing, respectively. I take this opportunity of thanking these gentlemen for their kind assistance. Finally, the letter F denotes those species which were collected during the dredging expeditions of the Liverpool Marine Biology Committee.

Family I.—Orchestiidæ.

Talitrus locusta, Latreille.

Colwyn Bay; abundant in drift seaweed at high water mark. W.

Family II.—Gammaridæ.

Sub-family—Stegocephalides.

Stenothoë (*Montagua*) *marina*, Sp. Bate.

Bar of Dee; W. Hilbre Island, one specimen; F., [S.]

Montagua alderi, Sp. Bate.

One specimen, Welshman's Gut, "Spindrift" expedition, June 20th. F.

Sub-family—Lysianassides.

Lysianassa costæ, M.-Edwards.

Off Puffin Island, fifteen fathoms, on cruise of "Hyæna,"

May 24th, 1885; F., W., [S.] The characters of the antennæ in this species are not reliable for specific distinction, the flagellum varying in length, and the accessory appendage in the number of joints.

"One of the specimens from Puffin Island has the flagellum of the lower antenna about four times as long as the peduncle, while in the other they are about the same length as the peduncle. In both, the secondary appendage is four to five-jointed, instead of two-jointed, as stated by Spence-Bate (*Brit. Sess. Crust.*, vol. i), and by Boeck." W.

Lysianassa longicornis, Lucas.

Off Puffin Island, fifteen fathoms; F., W., [S.] "Probably only a male of the last species"; W.

Orchomene minutus, Kröyer.

Colwyn Bay; one specimen, found in a tidal pool. W., [S.]

Sub-family—Phoxides.

Iphimedia obesa, Rathke.

Port Erin, Isle of Man, August, one specimen. F.

Sulcator arenarius, Sp. Bate.

Llanfairfechan. W., [S.]

Urothoë marinus, Sp. Bate.

Llanfairfechan. W., [S.]

Sub-family.— Gammarides.

Amathilla sabini, Leach.

Common at times, in tidal pools, at Rhos Bay. W.

Aora gracilis, Sp. Bate.

Point of Ayr, Rhyl, Puffin Island, fifteen fathoms; Carnarvon Bay, five to ten fathoms. W., F.

Atylus swammerdamii, M.-Edw.

Very common in and below the Laminarian zone; common off Bagillt, July 25, 1876, W.; Hilbre Swash, eighteen specimens, May 9th; Penmaenmawr, one specimen,

July; Welshman's Gut, June 20th, seven specimens; Port Erin, Isle of Man, August, one specimen. F.

Atylus gibbosus, Sp. Bate.
Port Erin, Isle of Man, August, one specimen. F.

Atylus (*Halirages*) *bispinosus*, Sp. Bate.
Rhos Bay. W.

Bathyporeia pilosa, Lindström.
Llanfairfechan. W., [S.]

Bathyporeia pelagica, var. *robertsoni*, Sp. Bate.
Llanfairfechan; W., [S.] This form, along with *Bathyporeia pilosa*, *Sulcator arenarius*, and *Urothoë marinus*, was dug out of the sand at Llanfairfechan by the Rev. T. R. R. Stebbing and Mr. Walker.

Calliope læviuscula, Kröyer.
Very common in tidal pools, Colwyn Bay; W. One specimen was dredged in Hilbre Swash, ten fathoms, F., [S.]

Calliope bidentata, Norman.
Point of Ayr. F., W., [N.]

Dexamine spinosa, Leach.
Rhos Bay, Carnarvon Bay; W. Port Erin, Isle of Man, August, eight specimens (two very small specimens lack the characteristic tooth on the first antennae, = *Dex. tenuicornis* ?); F.

Gammarus locusta, Linn.
Recorded by Byerley as abundant in tide pools everywhere around the coast.
Very common under stones, Colwyn Bay; W.
Hilbre Swash; Port Erin, Isle of Man; Welshman's Gut; Penmaenmawr; F.
"A black form is common. The red spots on the abdominal segments are not always present." W.

Gammarus marinus, Leach.

Port Erin, Isle of Man, four specimens. F.

Some specimens dredged from Welshman's Gut are apparently a variety between *G. locusta* and *G. marinus*, having the first two abdominal segments rounded off, but still not agreeing with *G. campylops* in the form of the last pair of feet. F.

Gammaropsis (*Eurystheus*) *erythrophthalmus*, Lilljeborg.

Puffin Island, fifteen fathoms, "Hyæna." F., W.

Megamoera othonis, M.-Edw.

One specimen, cruise of "Hyæna." F.

Melita palmata, Montagu.

Rhos and Colwyn Bays. W.

Melita obtusata, Montagu.

Point of Ayr; F., W. Off Puffin Island, "Hyæna;" F., W.

Moera batei, Norman.

Megamoera multidentata, Bate and West., *Brit. Sess. Crust.*, vol. ii, p. 515.

Puffin Island, fifteen fathoms. F., W., [N.]

"The specimen, taken April 27th, 1881, was named by the Rev. A. M. Norman. It is a female, and it differs widely from the figure given by Bate and Westwood, as regards the second cheliped (gnathopod of B. and W.). In our specimen, the wrist is three times as long, and nearly as wide, as the hand." W.

Pherusa bicuspis, Kröyer.

= *Pleustes bicuspis*.

Bar of Dee, Rhyl, Puffin Island, cruise of "Hyæna," fifteen fathoms. F., W.

Pherusa fucicola, Leach.

(See Sp. Bate, *Cat. Amphib. Crust. Brit. Mus.*, pl. xxvii, fig. 10—not fig. 9.) Rhos Bay; W., [N.] One specimen was

obtained in a tidal pool between Llandrillo yn Rhos and the Little Ormes Head.

Photis reinhardi, Kröyer.

Eiscladus longicaudatus, Sp. Bate.

One specimen from oyster-bed in Colwyn Bay, three to five fathoms. W.

Family III.—Corophiidæ.

Sub-Family.—Podocerides.

Amphithoë podoceroides, Rathke.

A. littorea, Sp. Bate = *A. rubricata*, Montagu.

Tidal pools, Rhos Bay; W. Port Erin, Isle of Man. Seven young specimens, one adult; F., [S.]

Podocerus falcatus, Montagu.

Generally distributed; W. Two specimens Port Erin, Isle of Man. F.

Podocerus pelagicus, Leach.

Five specimens, Port Erin, Isle of Man. F.

Podocerus pulchellus, Leach.

Six specimens, Port Erin, Isle of Man. F.

The last two species may be varieties of *P. falcatus*.

Podoceropsis sophia, Boeck.

Naenia tuberculosa, Sp. Bate.

Bar of Dee, Colwyn Bay. W.

Sunamphithöe hamula, Sp. Bate.

Six specimens, Port Erin, Isle of Man. F.

Cerapus abditus, Templeton.

Point of Ayr. F., W. "When alive, this species is prettily freckled, and the antennæ barred with red; eyes bright scarlet" (A. O. W.)

Sub-family.—Corophiides.

Corophium grossipes, Linn.

C. longicorne, Fabr.

On mud flats, its burrows covering acres in the Dee. W. In tide pools. Byerley.

Naenia rimipalmata, Sp. Bate.

N. excavata = *Xenoclea batei*, Boeck.

Penmaenmawr, one specimen; "Hyæna," one specimen. F., [S.]

Family IV.—Cheluridæ.

Chelura terebrans, Philippi.

In great numbers, in wood from the breakwater, Port Erin, Isle of Man. F.

Family V.—Dulichiidæ.

Dulichia porrecta, Bate.

Recorded by Bate and Westwood "from deep water between the Dee and the Mersey." (Dr. Walker.)

Family VI.—Hyperiidæ.

Hyperia medusarum, Müller.

H. galba, Montagu.

Colwyn Bay, etc.; common in *Rhizostoma*. W.

Family VII.—Caprellidæ.

Proto pedata, Mont.

Two specimens, Port Erin, Isle of Man. F.

Protella phasma, Dana.

"Very plentiful amongst seaweed, Zoophytes, and Sponges at Hilbre and elsewhere" (Byerley). Probably Mr. Byerley's specimens were *Caprella linearis*, which appears to be the commonest species of the family at Hilbre Island.

Seven adult and six young specimens of *P. phasma* were obtained off Port Erin, Isle of Man. F.

NOTE.—The six specimens from Port Erin, recorded as the young of *Protella phasma*, are thus regarded in consequence of a note of Mayer (*Fauna u. Flora d. Golf. v. Neapel*, VI, p. 30), though at first believed to be a new species. To prevent future error an outline drawing is appended, Pl. IV, fig. 1; none of the characteristic spines on the back are developed except that on the head; and the palm of the second cheliped is much simpler than that of the adult, exhibiting only one, not very strong, tooth. F.

Caprella linearis, Linn.

Forty-four specimens, mainly from Hilbre; one from Port Erin. Under this species is now ranked *C. lobata* as the male, as was suggested by Bate and Westwood, and definitely laid down by Mayer in his recent monograph on the Naples Caprellidæ. F.

Podalirius typicus, Kröyer.

On the interambulacral spaces of *Asterias rubens*. Off Prestatyn, abundant, July 10th, 1885. W.

The above list of species is entirely new to the district, except for the three recorded by Mr. Byerley, namely:—*Corophium longicorne*, *Gammarus locusta*, and *Caprella phasma*.

LIST OF THE ISOPODA.*

Family I.—CYMOTHOIDÆ.

Eurydice pulchra, Leach.

* I have drawn up this list from Byerley's *Fauna* and from notes supplied to me by Mr. A. O. Walker and Mr. I. C. Thompson.—ED.

"This species swarms in the Dee, where it bites bathers." W.

Family II.—Sphæromidæ.

Sphæroma serratum, Fabr.

Colwyn Bay; Mersey, above Ellesmere Port, under stones. W.

Family III.—Idoteidæ.

Idotea tricuspidata, Desmarest.

Colwyn Bay, Dee, etc. W.

Idotea linearis, Pennant.

Along the coast.

These two species of *Idotea* are often found on floating drift weed. W.

Arcturus longicornis, Sow.

Dredged at the mouth of the Dee. Byerley.

Family V.—Asellidæ.

Jaera albifrons, Mont.

Colwyn Bay and Rhos Bay, in tidal pools. W.

Janira maculosa, Leach.

Bar of the Dee. W.

Limnoria lignorum, Rathke.

Dee and New Brighton. Bate and Westwood.

Byerley records this species from the Mersey, under the name of *L. terebrans*, and states that the wooden piles of the Rock Lighthouse are completely drilled by it.

"I have never seen or heard of any signs of this wood-boring pest in the Dee, though I have asked men who have removed old piles." W.

Family VIII.—Oniscidæ.

Ligia oceanica, Linn.

Sparingly at Hilbre and Egremont. Byerley.

Colwyn Bay. W.

I am informed by Mr. Moore, that he and Mr. Marrat have seen at nightfall vast numbers of this species issue from between the layers of rock at Hilbre.

REPORT on the PODOPHTHALMATA of the L. M. B. C. DISTRICT.

By Alfred O. Walker, F.L.S., Chester.

Order.—PODOPHTHALMATA.

Sub-order.—SCHIZOPODA.

Family.—Mysidæ.

Mysis flexuosa, Müller.

Mysis Chameleon, Bell.

Dee, opposite Flint. Common in tidal pools at Rhos Bay (Colwyn Bay).

Mysis spiritus, Norman.

Rhos Bay.

Dredged off Puffin Island, depth fifteen fathoms, during the cruise of the "Hyæna," on May 24th, 1885.

Sub-order.—DECAPODA.

Section I.—MACROURA.

Family.—Carididæ.

Pasiphœa sivado, Risso.

Two specimens were taken in 1884, below Point of Ayr. Mr. Moore informs me that two specimens of this species were brought to him from the Mersey in 1864, and that one specimen was taken on the Cheshire coast late in 1885.

Palœmon serratus, Penn.

Common Prawn; sometimes taken in considerable numbers with the Shanks, but not very abundant anywhere.

Pandalus brevirostris, Rathke.

Hippolyte thompsoni, Bell.

Dredged off Puffin Island, depth fifteen fathoms, during the cruise of the "Hyæna," May 24th, 1885.

Pandalus annulicornis, Leach.

The Shank or Œsop Prawn. Very abundant on stony ground. Immense quantities are taken by the shrimp trawlers off Prestatyn.

Hippolyte pusiola, Kröyer.

One specimen was obtained off Puffin Island during the cruise of the "Hyæna," on May 24th, 1885.

The colouring of this species, when fresh, is very beautiful. The upper portion of the carapace is generally milky white, the under part and legs spotted with red; the abdominal segments more or less yellow, with a ring of white just above the tail.

Hippolyte cranchii, Leach.

One specimen was obtained off Puffin Island, during the cruise of the "Hyæna," on May 24th, 1885.

Hippolyte varians, Leach.

Common in tidal pools.

Crangon (*Cherophilus*) *trispinosus*, Hailstone.

Obtained off Puffin Island, from a depth of fifteen fathoms, during the cruise of the "Hyæna," May 24th, 1885.

Crangon (*Ægeon*) *sculptus*, Bell.

Three specimens were dredged off the south end of the Isle of Man.

Crangon (*Ægeon*) *fasciatus*, Risso.

Two specimens were dredged off Puffin Island, in fifteen fathoms, during the cruise of the "Hyæna," on May 24th, 1885.

Crangon vulgaris, Fabr.

Very abundant on sandy shores.

Family.—ASTACIDÆ.

Nephrops norvegicus, Linn.

Said to have been taken at Holyhead (*Bell's Brit. Crust.*, p. 254).

Homarus vulgaris, Edw.

Common Lobster. As far as I know this is not fished for nearer Liverpool than Amlwch, but it has been taken in Rhos Bay east of the Little Orme; it has been found on Hilbre Island by F. P. Marrat.

Family.—GALATHEIDÆ.

Galathea strigosa, Fabr.

One small specimen of this species, not half-an-inch long, but with eggs, was dredged off Puffin Island, fifteen fathoms, during the cruise of the "Hyæna," on May 24th, 1885.

Galathea intermedia, Lilljeborg.

Galathea andrewsi, Kinahan.

Obtained in the Menai Straits during the cruise of the "Hyæna," on May 24th, 1885; also in Hilbre Swash, depth ten fathoms; and off Port Erin, Isle of Man.

Galathea squamifera, Mont.

One specimen was dredged off the south end of the Isle of Man.

Section II.—ANOMOURA.

Family.—PAGURIDÆ.

Pagurus bernhardus, Linn.

Very abundant from Hilbre Swash and Point of Ayr all along the coast.

Pagurus prideauxii, Leach.

Off Port St. Mary, Isle of Man, along with *Adamsia palliata*.

Pagurus cuanensis, Thompson.

One specimen was dredged off the south end of the Isle of Man in August.

Family.—PORCELLANIDÆ.

Porcellana platycheles, Penn.

Hilbre Swash. Formerly common under stones at Penmaenmawr and Colwyn Bay, but I have seen none there lately.

Found at Hilbre Island last summer by some members of the Committee.

Porcellana longicornis, Penn.

Common under stones at Colwyn Bay, Penmaenmawr, etc.

A specimen found by Mr. Thompson at Penmaenmawr has the chelipedes equal.

Section III.—BRACHYURA.

Family.—CORYSTIDÆ.

Thia polita, Leach.

One specimen was obtained on the western end of the Constable Bank, near Llandudno, from a depth of six to seven fathoms, during the cruise of the "Hyæna," May 23rd, 1885.

Corystes cassivelaunus, Penn.

Along the coast from Hilbre Swash to Menai Straits.

Family.—LEUCOSIADÆ.

Ebalia tuberosa, Penn.

Ebalia pennantii, Leach.

Off the south end of the Isle of Man, one male specimen.

Ebalia tumefacta, Montagu.

Ebalia bryerii, Leach.

Off the south end of the Isle of Man, two female specimens.

Ebalia cranchii, Leach.

Off the south end of the Isle of Man, one male specimen.

It seems doubtful whether the last two species are distinct.

Family.—GONOPLACIDÆ.

Gonoplax angulata, Fabr.

One specimen has occurred at Southport (C. H. Brown).

Family.—PINNOTHERIDÆ.

Pinnotheres pisum, Penn.

In Mussel shells.

Family.—PORTUNIDÆ.

Carcinus mœnas, Linn.

Very abundant. Is there any reason why *Portunus carcinoides* (Kinahan, in *Nat. Hist. Review*, 1857), should not be referred to this species?

Portunus puber, Linn.

Point of Ayr, one specimen, 1878.

Portunus arcuatus, Leach.

Mouth of the Dee; Colwyn Bay. Not common.

Portunus depurator, Linn.

Very abundant, three to seven fathoms.

Portunus pusillus, Leach.

Off Port Erin, Isle of Man, one specimen.

Portumnus latipes, Penn.

Beach, Penmaenmawr (R. D. D.)

Family.—ERIPHIDÆ.

Pilumnus hirtellus, Linn.

Great and Little Ormes Heads; Puffin Island, seven to fifteen fathoms; Bar of Dee.

Family.—Cancridæ.

Cancer pagurus, Linn.

Rhos Bay; common, but small.

Family.—Parthenopidæ.

Eurynome aspera, Penn.

One specimen was obtained off Puffin Island, from a depth of fifteen fathoms, during the cruise of the "Hyæna," May 24th, 1885; off the south end of the Isle of Man, August, 1885.

Family.—Maiidæ.

Stenorynchus rostratus, Linn.

Stenorynchus phalangium, Penn.

Very common in stony places, five to ten fathoms.

Achæus cranchii, Leach.

Off Port Erin, Isle of Man, twenty fathoms (L. Adams).

Inachus dorsettensis, Leach.

Off Port Erin, Isle of Man; one specimen.

Hyas araneus, Linn.

Off Little Ormes Head, seven to ten fathoms.

Hyas coarctatus, Leach.

Stony places, five to ten fathoms.

REPORT on the PYCNOGONIDA of the L. M. B. C. DISTRICT.

By W. B. Halhed.

This group does not appear to have hitherto engaged much attention in this locality, the only previous record of examples found in the Liverpool Bay being in Mr. Byerley's *Fauna*, published in 1855, where only two species are mentioned, namely, *Pycnogonum litorale* and *Nymphon gracile*, which latter title, as a convenient name for all long-legged Pycnogonida, seems generally to have satisfied observers who have lacked the time or the interest to make careful examinations, and to mark the distinct differences which characterise the various genera of this interesting group of animals.

The L. M. B. C. dredging investigations of this first season enable us to add to the brief list at least five additional species, to wit:—

Phoxichilidium femoratum, Rathke.
Phoxichilus spinosus, Montagu.
Achelia echinata, Hodge.
Achelia hispida, Hodge.
Pallene brevirostris, Johnston.

and doubtless future work in the locality will still further extend the number.

As no complete detailed description has ever been given of the British Pycnogonida, it is necessarily a laborious and somewhat difficult matter to trace the history of the various species, and identify the specimens correctly. Fortunately, Dr. Hoek's "Challenger" Report, recently published, gives a list of all known species of the group, with references to

previous records; but these records are widely scattered, and not all available. The more important of the references are given below, under the head of the species to which they refer.

Some specimens, found both off the Isle of Man and off Puffin Island, have the characteristics of Mr. H. Goodsir's *Pephredo hirsuta*, a species which has never been sufficiently described. On account, however, of the uncertainty as to the exact characters of Goodsir's species, it is deemed better to place the specimens provisionally under the title of "*Nymphon gracile*," a species to which they are at least closely allied.

Some of the specimens of Pycnogonids collected had masses of ova, or embryos, attached, all apparently in a very early stage of development.

It is to be hoped that the investigations of the Liverpool Marine Biology Committee, during the coming summer, may lead to the acquisition of a larger number of specimens belonging to this interesting but obscure group. The British Pycnogonida seem to be still very imperfectly known. They require to be thoroughly examined, the species in some cases re-described and figured, and the synonymy cleared up. This, however, cannot be satisfactorily done until a considerable collection has been obtained.

In the arrangement and nomenclature of species, I have followed Hoek's Report upon the "Challenger" Pycnogonida (*Zool. Chall. Exp.*, Part x, 1881). The four families recognised by Hoek (Nymphonidæ, Colossendeidæ, Pallenidæ, and Phoxichilidæ). are all represented in the Liverpool Bay collection.

Family I.—Nymphonidæ.

Nymphon gracile (?), Leach.

Nymphon gracile, Leach, *Zool. Misc.*, vol. i, p. 45, 1814; Hoek, "Challenger" Report, p. 20.

This species is recorded by Mr. Byerley as being in most

rocky pools at Hilbre, New Brighton, &c. That may have been so in 1855, but it is certainly not the case now. However, it is really very doubtful what species was meant by *Nymphon gracile*, as that name has been applied by naturalists to a number of the commoner species of Nymphonidæ and the allied families indiscriminately.

Under this species may be placed provisionally some specimens obtained both off the south end of the Isle of Man (fifteen fathoms) and also off Puffin Island (eleven to thirteen fathoms), which show some of the characteristics of *Pephredo hirsuta*, a species described briefly by H. Goodsir in 1842. Goodsir's specimen was from the Isle of Man, but it has not been found since, and its position and relations are still very uncertain. The Liverpool Bay specimens appear to have more than three joints in the palpus, and therefore ought not to belong to the genus *Pephredo*. The examination of more material from this neighbourhood is much to be desired, as it may result in the clearing away of the existing doubts as to Mr. Goodsir's species.

Family II.—Colossendeidæ.

Achelia echinata, Hodge.

Achelia echinata, Hodge, *Ann. and Mag. of Nat. Hist.*, 3rd series, vol. xiii, p. 115, 1864; and Hoek, "Challenger" Report, p. 26.

One example of this Pycnogonid was obtained during the cruise of the "Hyæna," on 24th May, 1885. It has all the characteristics of Hodge's description. The species has previously been found at the Isle of Man, as well as at a few other points on the English coast.

Achelia hispida, Hodge.

Achelia hispida, Hodge, *Ann. and Mag. of Nat. Hist.*, 3rd series, vol. xiii, p. 115, 1864; and Hoek, "Challenger" Report, p. 27.

Two specimens, found during the cruise of the "Hyæna," appear to be referable to this species, which has only been previously found on the Cornwall coast. Hoek doubts whether this is a good species.

Family III.—Pallenidæ.

Pallene brevirostris, Johnston.

Pallene brevirostris, Johnston, *Mag. of Zool. and Bot.*, vol i, 1837; and Hoek, "Challenger" Report, p. 30.

A single specimen of this species was found off Spanish Head, Isle of Man, depth 20 fathoms.

Phoxichilidium femoratum (?), Rathke.

Nymphon femoratum, Rathke, *Naturh. Selsk. Skr.*, vol. i. p. 201, 1799.

Orithyia coccinea, Johnston, *Mag. of Zool and Bot.*, vol. i, p. 378, 1837.

Phoxichilidium femoratum (Rathke), Hoek, "Challenger" Report, p. 32.

One of the specimens dredged off Puffin Island during the cruise of the "Hyæna" belongs undoubtedly to the genus *Phoxichilidium*, and is probably the *Orithyia coccinea* of Johnston, which Hoek regards as the same species as Rathke's *Nymphon femoratum*. A further examination will, however, be necessary before the matter can be settled conclusively.

An immature specimen, obtained off Port Erin, Isle of Man, from a depth of twelve fathoms, probably belongs to this genus, but cannot be referred to its proper species.

Family IV.—Phoxichilidæ.

Phoxichilus spinosus, Montagu.

Phalangium spinosum, Montagu, *Linn. Transact.*, vol. ix, p. 100, 1808.

Phoxichilus spinosus (Montagu), Hoek, "Challenger" Report, p. 35.

Three specimens of this species were obtained during the dredging expeditions, one male and one female, brought up near Puffin Island from a depth of fourteen fathoms, during the cruise of the "Hyæna," on May 24th, 1885; and one female, dredged off Port Erin, Isle of Man, from fifteen fathoms, in August, 1885.

The Puffin Island specimens had been preserved in glycerine, and shewed well the characteristic colour of the species (purple red), but this colour was lost in the other specimen, which had been preserved in alcohol.

On the male specimen, obtained in May, ova in large quantity were attached to the legs.

Pycnogonum litorale, Ström.

Phalangium litorale, Ström, *Phys. og Œcon. Beskr.*, *&c.*, Soröe, 1762.

Pycnogonum litorale (Ström), Kröyer, *Bidrag til Kundskab, Nat. Tid. Ny. Raekke*, vol. i, p. 126, 1845; Hoek, "Challenger" Report, p. 35.

This well known and widely distributed species is fairly common in Liverpool Bay. It is recorded by Byerley as being "abundant amongst seaweed and Zoophytes where there are patches of rock."

It has been taken by members of the Liverpool Marine Biology Committee, during 1885, on the rocks at Hilbre Island, and in the neighbourhood of Penmaenmawr.

REPORT on the TESTACEOUS MOLLUSCA* of the L. M. B. C. DISTRICT.

By R. D. Darbishire.

During the past, their first season, the Committee's operations have necessarily been tentative only. At best, a dredge 30 inches wide, dragged for twenty minutes, at intervals of from half a mile to two miles or more apart, over unselected and unknown bottom, subject to unknown conditions of tidal or fluviatile influence, can exhibit only the merest glimpses of a fauna, and few indeed of accurate biological history. And the repetition of such a day's work at various times during the quiet days of summer, over different grounds, scarcely adds quality to the "research." Moreover, the Committee's district is characteristically wanting in rocky shores or bottom, and consequently in the vegetable growths on which many Mollusca feed.

The Committee has endeavoured to systematize specific observation at Hilbre Island (which is of red sandstone rock), and has already recognised the special gains of repeated visitation and record.

It is to be hoped that a similarly thorough examination of other particular localities will become part of their work, or will be undertaken by individual naturalists. The nature of the sea bottom has to be ascertained, mapped, apportioned, and studied, and the varying conditions of submarine equilibrium duly noted—partly by the help of actual survey

* The Nudibranchiata are discussed in a separate Report (see p. 267); and the specimens of Cephalopoda collected by the L. M. B. C. have been examined by Mr. Hoyle, of the "Challenger" Office, Edinburgh, who has furnished me with the notes forming the supplemental Report on the Cephalopoda found at p. 278.—[Ed.]

in regular lines, and partly by means of the experience of fishermen.

When information of this kind is accessible, the Committee or volunteers can select localities where the conditions of habitat can be carefully observed, and the assemblage of animals and their life histories definitely studied on the scale at which the Committee aims. If the naturalists' investigation is to assume any real completeness, such researches must in many cases moreover be repeated, not only month after month, but at dawn, at noon, at sunset, and at midnight.

For really effective work of the kind they contemplate, the Committee cannot long dispense with the employment of a special steamer and trained assistance. It is to be hoped that the narrative of what they have already done may help to bring about such an extension of their apparatus. As necessary a development must eventually be the establishment of a laboratory.

With regard to the Testaceous Mollusca, the actual experience of the Committee has been so slight that they can only offer a few memoranda rather than a detailed report.

The observations hitherto made have been only experimental, and, it is only too true that, except at and near the shore at Hilbre Island, if there are any spots between Formby Point and Puffin Island where Molluscs flourish, the Committee have not yet been fortunate enough to find them. A certain assemblage of dead shells, with a few living ones, was observed whenever the dredge was used, but the number of species, and indeed that of specimens, has been disappointing so far.

In what follows there has been no attempt to record the name of every species of which a dead shell was found (except

in § 3), but only to set down the more notable occurrences and a few observations.*

The matter in the reporter's hands is offered as follows:

(1.) A list of notable species taken, alive or dead, during any of the Committee's expeditions, including Mr. Thompson's Penmaenmawr and Professor Herdman's Isle of Man shells.

(2.) Some notes by collectors on particular species at different places on the shores of the Committee's district.

(3.) A table of local lists within the same district.

(1.) The Committee's List.

The Committee dredged on the 9th of May in Hilbre Swash; and on the 24th, 25th, and 26th of May (from the "Hyæna") off Llandudno, in the Menai Straits, and round Puffin Island; and again on the 20th of June off Hilbre Island and Point of Ayr.

They have had several special excursions for shore work on Hilbre Island at low water, and two or three members explored at Hoylake, and at Blundellsands and Waterloo; while Mr. Thompson worked continuously at Penmaenmawr and in dredging round Puffin Island. Professor Herdman dredged and searched the shores at the south end of the Isle of Man, for some weeks in July and August.

LAMELLIBRANCHIATA.

Anomia ephippium, L.

Off Port Erin, Isle of Man.

* It is a question how long dead shells may drift about on a sandy shore, buried and washed out again. A shore may be full of shells of many years' deposit. On the other hand, it seems certain that the multitude of country people and children who take shells home do really dispose of such accumulations. At Southport, *Turritella terebra* on the beach, and *Helix nemoralis* on the sandhills, are very much less common than they used to be.

Anomia patelliformis, L.

Valves, 14 fathoms, north of Puffin Island.

Ostrea edulis, L.

Single old specimens in Menai Straits, and off Penmaenmawr, and off Puffin Island.

Pecten pusio, L.

Pecten varius, L.

Pecten tigrinus, Müll.

Dead valves of these species, off Puffin Island, north, and off the south end of the Isle of Man. Young specimens of *P. varius* were also found at Port Erin, and also valves of *P. tigrinus*, var. *costata*.

Pecten opercularis, L.

Small specimens dredged on Constable Bank, Menai Straits, off Penmaenmawr, and off Puffin Island, and at Port Erin, Isle of Man, but not one full-grown one.

Lima loscombii, Sow.

Valves off Great Ormes Head, and at south end of Isle of Man.

Lima elliptica, Jeff.

Valves off south end of Isle of Man.

Mytilus edulis, L.

Occurs in large beds in the estuary of the Conway River, and at various places on the shore, and in deeper water east and west of Great Ormes Head.

Mytilus barbatus, L.

Off Puffin Island, alive, amongst a mass of dead shells.

Modiolaria marmorata, Forbes.

Port Erin, Isle of Man.

Nucula nucleus, L.

Dredged off south end of Isle of Man.

Pectunculus glycimeris, L.

Valves and young specimens dredged off Port Erin and Port St. Mary, Isle of Man.

Cardium echinatum, L.

Penmaenmawr.

Cardium norvegicum, Speng.

Young shells living in Menai Straits, and off south end of Isle of Man.

Astarte sulcata, Da C.

Two specimens from Port Erin, Isle of Man.

Venus fasciata, Da C.

Living with the last.

Venus casina, L.

Living, both large and small, off Port Erin, Isle of Man.

Venus gallina, L.

One large old specimen and several smaller, from Port Erin and Port St. Mary, Isle of Man. They are rather pale in colour. Common at low-water at Penmaenmawr and Southport.

Venus exoleta, L.

Large valves were dredged off Port Erin, Isle of Man.

Venus ovata, Penn.

Dead valves, fourteen fathoms, off Puffin Island, N.

Tapes pullastra (*perforans*), Mont.

At Hilbre Island.

Tapes virgineus, L.

Port Erin, Isle of Man.

Tellina donacina, L.

Fourteen fathoms, off Puffin Island.

Tellina balthica, L.

New Brighton, Port Erin, &c. Everywhere on sandy shores.

Psammobia tellinella, Lam.

One large and well-coloured shell taken living in Menai Straits.

Psammobia ferroensis, Chem.

Valves. Occurs alive and fine, in channels at low-water, near Penmaenmawr.

Mactra solida, L.

Not unfrequent off Constable Bank, Menai Straits, and north of Puffin Island, living, old and young, many characteristic and fine specimens; also, off Port Erin, Isle of Man.

Mactra solida, var. *elliptica*.

Young, from Port Erin, and off Great Ormes Head.

Mactra stultorum, L.

With the last, but not so common or so fine. Valves common on Waterloo Shore.

Lutraria elliptica, Lmk.

Valves frequent at Penmaenmawr, and occur at Southport.

Scrobicularia prismatica, Mont.

A few valves off Puffin Island, N.

Scrobicularia alba, Wood.

Living specimens rare, and dead valves frequent with the last. Extremely abundant on the Red Wharf Bay sands. Sometimes, in summer, a *ridge* of these shells, quite fresh, but without the animal, will lie on high-water mark for very many yards.

Thracia prætenuis, Pult.

Port Erin, Isle of Man. Dredged alive.

Corbula gibba, Olivi.

During cruise of "Hyæna," six miles off Great Ormes Head, fourteen fathoms.

Mya binghami, Turton.

One alive in a crevice at the base of *Alcyonium*, from fourteen fathoms, north of Puffin Island.

Mya arenaria, L.

Abundant in mud at Bagillt, and sometimes eaten. Large specimens used to be obtained alive in the Mersey. This species is now spreading and multiplying northwards from Crosby, in muddy places. It is sold for food at Crosby.

Saxicava rugosa, L.

Same locality, and also common on *Laminaria*, off Port St. Mary, Isle of Man.

Pholas crispata, L.

In red sandstone rock, at Hilbre Island, up to about two inches in length.

SCAPHOPODA.

Dentalium entale, L.

Alive, off south end of Isle of Man. Dead, trawled off Red Wharf Bay, seven to eight fathoms. Not uncommon on beach at Penmaenmawr and Southport.

POLYPLACOPHORA.

Chiton cancellatus, Sow.

Off south end of Isle of Man.

Chiton albus, L.

Off south end of Isle of Man.

Chiton cinereus, L.

Off south end of Isle of Man. Also in Menai Straits and at Penmaenmawr. Very common.

Chiton lævis, Mont.

Off south end of Isle of Man. Also in Menai Straits.

GASTROPODA.

Patella vulgata, L.

Common on shore at Port Erin.

Helcion pellucidum, L.

On *Laminaria*, Port St. Mary, and Colwyn Bay.

Emarginula fissura, L.

Port Erin.

Fissurella græca, L.

Off south end of Isle of Man.

Trochus magus, L.

Several large specimens of the (Manx) coarse pallid form, from near Port Erin.

Trochus cinerarius, L.

Port Erin and Port St. Mary, on the shore, large. Bar of Dee, Colwyn Bay, Great Ormes Head.

Trochus tumidus, Mont.

Off south end of Isle of Man.

Trochus zizyphinus, L.

Alive, off south end of Isle of Man.

Alive, with *Mactra solida*, off Great Ormes Head, seven to eight fathoms.

Phasianella pullus, L.

Off south end of Isle of Man.

Velutina lævigata, Penn.

Off Port Erin, etc., Isle of Man.

Aporrhais pespelicani, L.

Off north end of Isle of Man, ten to twenty fathoms.

Buccinum undatum, L.

Very common all along the Welsh coast, living at and below low-water.

Murex erinaceus, L.

Off Port St. Mary, etc. Fine specimens dredged in Menai Straits, off Puffin Island.

Natica catena, Da Costa.

Natica alderi, Forbes.

Fusus antiquus, L.

From south end of Isle of Man.

Off Great Ormes Head, seven to eight fathoms.

Fusus gracilis, Da Costa.

Dead, both localities with last species. Alive, off the Little Ormes Head (A. O. W.)

Trophon muricatus, Ström.

Off south end of Isle of Man.

Trophon barvicensis, John.

Young, Port Erin, Isle of Man.

Mangelia turricula, Mont.

Living, Port Erin, and also off Penmaenmawr.

Mangelia nebula,

Port Erin, Isle of Man.

Philine aperta, L.

Off Penmaenmawr, living.

Cypræa europæa, Mont.

Off Penmaenmawr, and off south end of Isle of Man; adult and young.

Aplysia punctata, Cuv.

Off Port Erin, Isle of Man, ten to twenty fathoms, common.

Pleurobranchus membranaceus, Mont.

South end of Isle of Man, shore, common in some places.

[For the list of Cephalopoda see end of Special Notes, p. 245.—Ed.]

(2.) Special Notes.

Anomia patelliformis and *Pecten pusio* occur frequently as dead valves of very old individuals on the beach at Penmaenmawr, telling of some oyster bed within reach of the shore currents. The oyster bed may have ceased to exist for years.

Pecten maximus, L. Dead valves occasionally at Penmaenmawr.

Mytilus edulis. Young and small pellucid shells sometimes clothe the large stones at low water at Blackpool, where large shells are seldom found.

Since the railway very greatly increased the export into Lancashire, etc., of mussels from Conway Bay, the average size has greatly decreased. Some years ago, large quantities of mussels were raked up in Conway Bay, and boiled in huts on the east shore to get seed pearls. These were bought by a traveller at 4s. per oz. A woman could earn 12s. per week at this harvest (see *Land and Water*, Oct. 15, 1872). The trade has ceased, but large masses of blue shells (which have been described as raised sea bottom) remain above the shore.

Mytilus modiolus, L. Sometimes, in summer, a number of specimens of this animal will be thrown up on Penmaenmawr beach, alive, often enclosing *Pinnotheres pisum*.

Cardium echinatum occurs fresh and fine at Penmaenmawr and at Southport, but I have never seen the animal, and do not know where it lives (D.)

Cardium edule is largely collected on Conway and Lavan sands, and on the banks off Bagillt and Holywell, and at Southport and Blackpool.

A curious variation of habit arises when young cockles get amongst mussels, and, being anchored by the byssus threads of the latter animal, grow and develop freely without being buried in sand, as well-bred cockles should be. These open-water cockles produce a circular, delicate, and very pretty variety of shell (Conway Bay).

Cyprina islandica has, not unfrequently, been found alive in the channels between banks of the Lavan Sands, off Llanfairfechan (probably cast out from some of the seagoing hookers as they are cleaned up while running in to Bangor).

In one such shell was found a fine specimen of *Malacobdella grossa*. A workman at Penmaenmawr, who ate *Cyprina*, was said to have been badly "musselled."

Venus lincta, Pult., and *V. exoleta*, L. Valves occur at Penmaenmawr.

Venus fasciata. Common at low-water, at Beaumaris.

Tapes virgineus occurs on the beach at Penmaenmawr and Colwyn, and dredged off Llandudno and Conway.

Tapes pullastra is common on the same beaches, but I have not found its habitat (D.).

Tapes decussatus. The like remarks as to this. Large valves occurred in a kitchen midden on the Ormes Head, at Gwyfyd, near Llandudno.

Lucinopsis undata, Penn. Occurs fresh, but without the animal, at Penmaenmawr.

Tellina crassa, valves found at Colwyn Bay.

Ceratisolen legumen and *Solen vagina*, both species somewhat localised occur in abundance and well grown in the low water channels below Penmaenmawr. The former, and a small form of *Solen ensis*, very abundant at Southport.

Mactra stultorum. Very common and large at Southport and Blackpool, where they used to be eaten boiled or raw. Sometimes immense quantities of young shells are cast up along high-water mark, quite fresh, but without the animals.

Solen pellucidus is dredged fine in Conway Bay, four to six fathoms.

Thracia convexa, dead valves occur occasionally on the beach at Southport. I have dredged fresh valves (but not the mollusc) off Whitehaven (D.).

Thracia papyracea is often thrown up on the beach at Penmaenmawr in considerable numbers, but I have never found it at home (D.).

Mya truncata lives in the channels below Bangor, in stinking black mud, growing large, but discoloured in the shell.

A form, greatly abbreviated, occurs within the influence of the Conway River.

Sometimes large numbers are thrown up by the sea on Colwyn sands, with the chitinous siphon cases quite perfect, but the animal altogether gone.

Saxicava rugosa, which is extraordinarily abundant in the limestone on Puffin Island and Anglesey tidal rocks, may sometimes be dredged amongst dead shells in Conway Bay of a large size and free growth.

Pholas crispata. This shell occurs rarely at Southport, and more frequently from Point of Ayr to Rhyl and Abergele as very worn dead valves of large size. It lives in the red sandstone rock at Hilbre Island, where it grows to about two inches in length.

A prolonged search at last found this animal living in abundance, and of very great size, in coarse sandy mud near Beaumaris. Specimens measuring 3·4 inches are not uncommon, and 3·7 inches and 3·8 inches have occurred to me. I have found shells of this species, subfossil, at Bracklesham Bay 4·2 inches long (D.).

Pholas candida. A curious distribution of valves along the shore from Southport past Formby Point was noticed. North of the Point, one valve was common and the other rare; southward, the latter valve was the common one. Experiment proved that this separation was probably due to the behaviour of a shell, so peculiarly shaped and balanced, in the prevailing tidal flux, as it brought the valves up from low-water. Great colonies in blue clay at low-water at Blackpool. Sometimes eaten boiled.

Chiton fascicularis occurs of large size amongst stones west of Redwharf Bay, Anglesey.

Helcion pellucidum occurs of large size amongst *Laminaria* on Puffin Island.

Tectura testudinalis occurs rarely amongst shingle at low water at Fleetwood.

Crepidula fornicata, L., has been found amongst the shells of *Ostrea virginica*, Gmel., of which vast numbers were planted (apparently in vain) on the shore near Beaumaris.

Natica alderi, lives and grows large in channels near low water below Penmaenmawr.

Lamellaria perspicua, L., under stones at Bagillt.

Velutina lævigata, dredged in Menai Straits.

Aporrhais pespelicani. Common on the beach, Red Wharf Bay, and found from Formby to Blackpool. At Southport sometimes with the animals.

Fusus antiquus. The large form of this mollusc, with its fine white shell, measuring 7·5 to 8 inches in length, is said by Mr. Jeffreys to be "peculiar to the Cheshire coast." It is certainly fished by men from Menai Bridge on the way to Fleetwood, whither they take large quantities to be sold for bait. It would be a fit object for the Committee to aim at to find where this *Fusus*, our largest testaceous mollusc and our most beautiful shell, is actually at home, and to investigate the conditions of his life there.

Fusus gracilis is washed up abundantly on Red Wharf beach.

Fusus propinquus also.

Fusus jeffreysianus also has occurred on the same shore.

Cylichna cylindracea, Penn. Beach, Penmaenmawr and Southport.

Actæon tornatilis, L. Frequent on the beach (dead) at Penmaenmawr and Southport.

Scaphander lignarius, L. Beach, Red Wharf Bay and Southport.

CEPHALOPODA.

Ommastrephes sp.? A fine specimen, taken 25 m. S.E. of Douglas Head, was brought quite fresh to the Liverpool Museum, in April, 1860 (T. J. Moore).

Loligo media, L., of which four specimens were captured on May 23rd off the Constable Bank, near Llandudno, during the cruise of the "Hyæna," is common in the Menai Straits, frequent in the dredge, and in the fishing wires, and not uncommon when the "seine" is drawn on Penmaenmawr sands on a summer evening. Dredged at Leasowe (T. J. Moore).

Bunches of spawn, differing from, but similar to, that of *L. vulgaris*, occur on Penmaenmawr beach.

Loligo vulgaris, L., is taken in the fishing wires in Menai Straits.

Rossia macrosoma, Delle Ch., has been taken alive at Southport after a S.W. storm; and has been found at Rhyl and Bagillt, by Mr. A. O. Walker. Also at Red Wharf Bay, Anglesey (D.). Also at New Brighton, and at Egremont (T. J. Moore).

Sepia officinalis, Linn. The shell is drifted on shore occasionally from Penmaenmawr to Southport. One individual was brought to the Liverpool Museum alive, twenty years ago. It swam in the tank with great rapidity, struck the end violently, and died immediately (T. J. Moore).

Sepia biserialis has been found at Southport. Mrs. Plant found a number of the shells at Cymmeran Bay, on the west coast of Anglesey.

Octopus vulgaris, Lmk. A large female was taken in the Albert Dock, Liverpool, September, 1854 (T. J. Moore).

Eledone cirrosa, Lam., is not infrequent amongst the stones at low water at Great Ormes Head. In 1885, one large specimen was found alive on Hilbre Island, and a

young specimen was dredged to the north of Puffin Island. It has been found several times at Colwyn Bay, by Mr. A. O. Walker. Found at Seacombe, and at New Brighton, and frequently brought to the Liverpool Museum alive by local fishermen (T. J. Moore).

Sepiola atlantica, D'Orb. Six specimens were dredged in the Menai Straits on May 24th, and one small specimen was obtained on May 25th, north of Puffin Island. One specimen was dredged off Point of Ayr in June. Frequent in the fishing wires in the Straits (A.). Frequently brought alive to the Liverpool Museum (T. J. Moore).

(3.)

COMPARATIVE TABLE OF OCCURRENCE OF THE SPECIES.

Explanation.

a. *abundant.* c. *common.* r. *rare.* i. *only occasional individuals.* d. *dead shells.* l. *living.* + *occurrence only.*

Menai Straits, Bridges to Penmaenmawr.—Dr. T. Alcock, R. D. D., and A. O. Walker.

North of Puffin Island, Redwharf Bay.—Prof. E. Forbes, *British Marine Zoology*, British Association, 1860, and R. D. D.

Liverpool,* including Dee Mouth.—Mr. Byerley, *Literary and Philosophical Society of Liverpool, Proceedings*, viii, 1853–4. Mr. T. J. Moore, Mr. F. Archer, and others.

Formby and Southport.—Mr. C. B. Brown, in Dr. Nichols' *Southport*, 1861, and *Naturalists' Scrap Book*, Liverpool. Dr. Alcock and R. D. D.

Blackpool and Fleetwood.—R. D. D.

Isle of Man (South).—Prof. Herdman.

Isle of Man (North).—Prof. E. Forbes, *Malacologia Monensis.*

Glacial Drift.—Moel Tryfaen and Blackpool, from Mr. Shone's paper, *Geological Soc. Q. J.*, May, 1878. *Liverpool and Wirral*, by Mr. G. H. Morton, F.G.S., and from Mr. Reade's paper, *Q. J. G. S.*, Feb., 1874.

* The indication of frequency in the Liverpool column is not of certainty, as Mr. Byerley's notes do not in every case deal with that question.

	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island. Redwharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).				Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Blackpool.	Liverpool and Wirral.
MOLLUSCA.																			
LAMELLIBRANCHIATA.																			
Anomia ephippium. L.	-	c	+	+	+							c		+			+		+
,, *patelliformis.* L.	-	c	+	+										+					
Ostrea edulis. L.	-	c	+	+		+		r		r				+			+	+	
Pecten pusio. L.	-	r	+	+	+							r		+					
,, *varius.* L.	-	c	c	+		+		r		r		r		+			+		+
,, *opercularis.* L.	-	c	c	+	a		a	c	r	r		r		+					
,, *tigrinus.* Müll.	-	r	+	+							+								
,, *septemradiatus.* Müll.	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
,, *testæ.* Biv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *striatus.* Müll.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *similis.* Lask.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *maximus.* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lima sarsii. Lov.	-	r	r	r	r	r	c	r	r	r	r	r	r	+	r	r			
,, *elliptica.* Jeffr.	-	-	-	+	-	-	-	-	-	-	r	r	-	-	-	-	-	-	-
,, *subauriculata.* Mont.	-	r	-	-	-	-	-	-	-	-	r	r	-	+	-	-	-	-	-
,, *loscombii.* Sow.	-	-	-	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-
,, *hians.* Gm.	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Avicula hirundo. L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pinna rudis. L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus edulis. L.	-	a	a	r	+	a	c	c				c		+			+		+

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Red Wharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).			Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Blackpool.	Liverpool and Wirral.
LAMELLIBRANCHIATA—*continued.*																		
Montacuta bidentata. Mont.			+			i	r											
,, *ferruginosa.* Mont.					c	c	i											
Lasæa rubra. Mont.		c		+										+				
Kellia suborbicularis. Mont.				+										+				
Loripes lacteus. L.							i											
,, *divaricatus.* L.																		
Lucina spinifera. Mont.																		
,, *borealis.* L.			+											+				
Axinus flexuosus. Mont.	r						i											
,, *croulinensis.* Jeffr.																		
,, *ferruginosus.* Forb.																		
Diplodonta rotundata. Mont.			+															
Cyamium minutum. Fabr.														+				
Cardium aculeatum. L.																		
,, *echinatum.* L.	c	r	c		c	r	c	r						+		+	+	+
,, *tuberculatum.* L.																		+
,, *papillosum.* Poli.																		
,, *exiguum.* Gm.																		
,, *fasciatum.* Mont.														+		+		
,, *nodosum.* Turt.																		

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Hedwhart Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).				Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Try-faen.	Black-pool.	Liver-pool and Wirral.
LAMELLIBRANCHIATA—*continued.*																			
Tellina squalida. Pult.	-																		
,, *donacina.* Don.	-	r	r	+		r	i												+
,, *pusilla.* Phil.	-	-	i																
Psammobia tellinella. Lmk.	-	r											+						
,, *costulata.* Turt.	-	-																	
,, *ferroensis.* Chem.	-	r	r	r	+		r	r	r				+				+		+
,, *vespertina.* Chem.	-	-																	
Donax vittatus. Da C.	-	c	c	c		a	c	c	c				+				+		+
,, *truncatus.* L.	-	-			+														
,, *politus.* Poli.	-	-																	
Amphidesma castaneum. Mont.	-	-																	
Mactra solida. L.	-	c	c	r		c	c	c	c		c		+				+	+	+
,, *subtruncata.* Da C.	-	r	r	r	+	r	r	r	r										
,, *stultorum.* L.	-	c	c	c		c	c	a	a										
,, *glauca.* Born.	-	-																	
Lutraria elliptica. Lmk.	-	c		+		r		c	i				+				+		+
,, *oblonga.* Chem.	-	-																	
Scrobicularia prismatica. Mont.	-		r	+															
,, *nitida.* Müll.	-																		
,, *alba.* Wood.	-	a	a	a		a	c	c											

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Red wharf Bay.		Liverpool		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).			Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Blackpool.	Liverpool and Wirral.
LAMELLIBRANCHIATA—*continued.*																		
Gastrochaena dubia. Penn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholas dactylus. L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *candida.* L.	-	c	c	r	a	a	a	r	-	c	-	-	-	-	-	-	+	-
,, *parva.* Penn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *crispata.* L.	-	r	r	+	a	i	i	-	-	-	-	r	+	-	-	-	+	+
Pholadidea papyracea. Turt.	-	-	-	-	i	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylophaga dorsalis. Turt.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Teredo norvegica. Speng.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *navalis.* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *pedicellata.* Quat.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *megotara.* Han.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *malleolus.* Turt.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *bipinnata.* Turt.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHOPODA.																		
Siphodentalium lofotense. Sars.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadulus subfusiformis. Sars.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *jeffreysi.* Mont.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalium entale. L.	-	r	-	r	r	r	r	r	-	-	-	r	+	-	-	+	-	+
,, *tarentinum.* Lmk.	-	-	-	-	-	-	r	r	-	-	-	-	-	-	-	-	-	+
,, *abyssorum.* Sars.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Red wharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).			Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Blackpool.	Liverpool and Wirral.
GASTROPODA—*continued.*																		
Calyptræa chinensis. L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haliotis tuberculata. L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scissurella crispata. Flem.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclostrema cutlerianum. Cl.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *nitens.* Phil.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *serpuloides.* Mont.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trochus helicinus. Fabr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *grenlandicus.* Chem.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *glaucus.* Müll	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *amabilis.* Jeff.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *magus.* L.	-	r	-	+	-	c	-	r	-	-	-	c	-	+	-	-	-	-
,, *tumidus.* Mont.	-	r	-	+	-	r	-	-	-	-	-	r	-	+	-	-	-	-
,, *cinerarius.* L.	-	c	c	+	c	c	-	r	-	c	-	c	-	+	-	-	-	-
,, *umbilicatus.* Mont.	-	c	-	-	i	-	-	-	c	-	-	-	-	+	-	-	-	-
,, *dumingi.* Req.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *lineatus.* Da C.	-	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *montacuti.* W. Wood	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
,, *striatus.* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
,, *exasperatus.* Penn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
,, *millegranus.* Phil.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	Menai Straits, Bridges to Penmenmawr.		North of Puffin Island. Red wharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).				Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Blackpool.	Liverpool and Wirral.
GASTROPODA—*continued.*																			
Rissoa costulata. Ald.		-		-															
,, *striata.* Ad.		-		-			r												
,, *proxima.* Ald.		-	+	-															
,, *vitrea.* Mont.		-		-	r														
,, *pulcherrima.* Jeff.		-		-															
,, *fulgida.* Ad.		-		-															
,, *soluta.* Phil.		-		-															
,, *semistriata.* Mont.		-		-															
,, *cingillus.* Mont.		-		-			r						+						
Hydrobia ulvæ. Penn.		-		-		a	a	a											
,, *ventrosa.* Mont.		-		-															
Barleeia rubra Mont.		-		-															
Jeffreysia diaphana. Ald.		-		-															
,, *opalina.* Jeff.		-		-															
,, *globularis.* Jeff.		-		-															
Skenea planorbis. Fabr.		-		-											+				
Homalogyra atomus. Phil.		-		-											+				
,, *rota.* F. and H.		-		-															
Cæcum trachea. Mont.		-		-															
glabrum Mont.		-		-															

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Redwharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).				Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Try-faen.	Black-pool.	Liver-pool and Wirral.
GASTROPODA—*continued.*																			
Odostomia obliqua. Ald.		-																	
,, *warreni.* Thomp.		-																	
,, *dolioliformis.* Jeff.		-																	
,, *decussata.* Mont.		-																	
,, *clathrata.* Jeff.		-																	
,, *indistincta.* Mont.		-																	
,, *interstincta.* Mont.		-						i						+					
,, *spiralis.* Mont.		-																	
,, *eximia.* Jeff.		-																	
,, *fenestrata.* Forbes.		-																	
,, *excavata.* Phil.		-																	
,, *scalaris.* Phil.		-																	
,, *rufa.* Phil.		-						r						+					
,, *lactea.* L.		-						i											
,, *pusilla.* Phil.		-																	
,, *scillæ.* Souc.		-																	
,, *acicula.* Phil.		-																	
,, *nitidissima.* Mont.		-																	
Ianthina rotundata. Leach.		-																	
Stylifer turtonæ. Brod.		-																	

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Red-wharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).		Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Black-pool.	Liver-pool and Wirral.
GASTROPODA—*continued.*																	
Purpura lapillus. L.		r a		+	r	a	r	c	r	r		c	+	+	+	+	+
Buccinum undatum. L.		c	c	c								r					
,, *humphreysianum.* Ben.		c	c	c			c	c					+	+	+	+	+
Buccinopsis dalei. J. Sow.																	
Triton nodifer. Lmk.																	
,, *cutaceus.* L.																	
Murex erinaceus. L.		r		+	r	r	r	r	r			r	+	+	+	+	+
,, *aciculatus.* Lmk.																	
Lachesis minima. Mont.							i	i				+					
Trophon muricatus. Mont.			+								+	+	+	+	+	+	
,, *barvicensis.* Johnst.		r							r	c							
,, *truncatus.* Str.							r	c			r	r	+	+	+	+	+
Fusus antiquus. L.		r	c	+	c	c	c	c									
,, *norvegicus.* Chem.		c															
,, *turtoni.* Bean.																	
,, *islandicus.* Chem.			c														
,, *gracilis.* Da C.		r					r		r	i	r		+		+		+
,, *propinquus.* Ald.		i							i								
,, *buccinatus.* Lmk.		i															
,, *berniciensis.* King																	

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	Menai Straits, Bridge to Penmaenmawr.		North of Puffin Island, Red wharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).			Glacial Drift.		
	D	L	D	L	D	L	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Black-pool.	Liver-pool and Wirral.
GASTROPODA—*continued.*																		
Ovula patula. Penn.																		
Cylichna acuminata. Brug.																		
,, *nitidula.* Lov.																		
,, *umbilicata.* Mont.																		
,, *cylindracea.* Penn.		r			r		r											
,, *alba.* Bro.																		
Utriculus mammillatus. Phil.																		
,, *truncatulus.* Brug.																		
,, *obtusus.* Mont.					a		r	r										
,, *ventrosus.* Jeff.																		
,, *expansus.* Jeff.																		
,, *hyalinus.* Turt.																		
Acera bullata. Müll.																		
Actæon tornatilis. L.		r			r													
Bulla hydatis. L.																		
,, *utriculus.* Broc.																		
Scaphander lignarius. L.		r	r	+	i		r							r				
Philine scabra. Müll.																		
,, *catena.* Mont.																		
,, *angulata.* Jeff.																		

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	Menai Straits, Bridges to Penmaenmawr.		North of Puffin Island, Red wharf Bay.		Liverpool.		Formby and Southport.		Blackpool and Fleetwood.		Isle of Man (South).		Isle of Man (North).				Glacial Drift.		
	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L	Moel Tryfaen.	Black-pool.	Liver-pool and Wirral.
CEPHALOPODA—*continued.*																			
Loligo media. L.		r																	
Rossia macrosoma. D. Ch.						r		i											
,, *papillifera.* Jeff.																			
,, *oweni,* Ball.						a													
Sepiola atlantica. D'Orb.		c				r		i						r					
Sepia officinalis. L.						r										r			
,, *elegans.* D'Orb.								i											
,, *biserialis.* De Mont.																			
Octopus vulgaris. Lmk.																			
Eledone cirrosa. Lmk.		r				r								r					
Leda pernula -																	+	+	+
Astarte borealis, Chem.																			
Natica affinis, Gm.																			
Fusus antiquus, var. *contrarius*																	+		
,, ,, *despectus*																			

REPORT on the NUDIBRANCHIATA of the L. M. B. C. DISTRICT.

By W. A. Herdman, D.Sc., F.L.S.,
PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL.

This region of the Irish sea has an abundant Nudibranch fauna, and one spot in the neighbourhood of Liverpool, namely, Hilbre Island, is justly celebrated as being the original locality for *Antiopa hyalina*, and some other rare forms, and also on account of the number of other species found on its shores.

Mr. Byerley, in 1855, gave a list of twenty-two species of Nudibranchs, illustrated by a coloured figure of *Antiopa hyalina*. This list included several very rare forms which had been first discovered by himself and by Mr. Price, and had been described by Messrs. Alder and Hancock, in their Ray Society Monograph.*

A few years later (1860), Dr. Collingwood published lists of the Nudibranchiate Mollusca of the Mersey and the Dee in the *Annals and Magazine of Natural History*.† Dr. Collingwood recorded twenty-eight species.

I am indebted to Mr. J. Price, of Chester, for having very kindly placed at my disposal his MS. notes on the Fauna of the Estuary of the Mersey, dating back as far as 1840; some of the records of species given below are on Mr. Price's authority.

* "British Nudibranchiate Mollusca," 1844–1855.
† See this volume, p. 25.—Ed.

NUDIBRANCHIATA.

Sub-order.—ACANTHOBRANCHIATA.

Family.—Dorididæ.

Archidoris * *tuberculata*, Cuvier.

This species is not uncommon in this neighbourhood. Byerley records it from Hilbre Island, Caldy Blacks, and the rocks at New Brighton. It is very variable in size and colouring. Alder and Hancock state that a specimen five inches in length was obtained by Mr. Price on the coast of North Wales in 1852. It has been taken by the Committee frequently at Hilbre Island, and other places in the neighbourhood.

It was found frequently on the rocks at Port Erin, Isle of Man, during August.

Archidoris johnstoni, Alder and Hancock.

One specimen was found by Mr. Byerley, at Hilbre Island, in 1851. Mersey and Dee, once or twice (Collingwood).

Archidoris flammea, Alder and Hancock.

This rare species was dredged by Prof. Ed. Forbes off Ballaugh, Isle of Man, from a depth of twenty-five fathoms.

Lamellidoris bilamellata, Linnæus.

Recorded by Byerley and by Price from New Brighton, Hilbre Island, &c. Byerley states that the large brown variety is sometimes plentiful on the rocks at Hilbre, while "a smaller and lighter coloured variety is abundant on the dock wall at Woodside, and along the Cheshire side of the Mersey." Mr. Price informs me that this species used to be of particularly large size at Tranmere. It spawns in March, and disappears from the shore at the end of May.

* Bergh, in his *Report upon the "Challenger" Nudibranchiata*, replaces, for reasons there explained (*loc. cit.*, p. 84), the Linnæan *Doris* by the new generic title *Archidoris*, which I have adopted.

Lamellidoris depressa, Alder and Hancock.

Mr. Byerley states that he once met with a specimen of this small species at Hilbre Island.

Lamellidoris proxima, Alder and Hancock.

This species was first discovered on the Birkenhead shore by Mr. Price. He informs me that he found it abundant and spawning, on February 21st, 1845. Mr. Byerley records that it was extremely common on the shore between Egremont and New Brighton in August, 1855. He has also taken it freely at Hilbre Island, and had met with white and yellow varieties.

Acanthodoris pilosa, Müller.

This species is not uncommon; Byerley records it from "Hilbre Island, Caldy Blacks, and other rocky places." He also mentions having obtained a deep purplish-black variety at Hilbre; this is the *Doris nigricans* of Fleming, it has been taken in the Firth of Forth.*

The ordinary light-coloured form of *Acanthodoris pilosa* has been found several times lately at Hilbre Island by the Committee.

Acanthodoris quadrangulata, Alder and Hancock.

Doris subquadrata, Alder and Han.

The second specimen known of this rare species was found by Mr. Byerley and Mr. Webster at Caldy Blacks, and was examined and named by Mr. Alder.

Family.—Polyceridæ.

Goniodoris nodosa, Montagu.

Isle of Man (Forbes).

Penmaen-rhos and Llandrillo Bay, North Wales (Price.)

* See Leslie and Herdman, *The Invertebrate Fauna of the Firth of Forth*, Edinburgh, 1881, p. 103.

Goniodoris castanea, Alder and Hancock.

A fine specimen of this rare species, $1\frac{1}{8}$ inches in length and of rather a dark colour, was dredged in August, 1885, between Port St. Mary and Spanish Head, Isle of Man, from a depth of twenty fathoms; bottom, Nullipore. I dredged a similar specimen a few years ago in deep water off Holy Isle, Lamlash Bay, Arran.

Triopa claviger, Müller.

This species has been dredged by Forbes off the Isle of Man.

Polycera lessoni, d'Orbigny.

Mr. Byerley dredged one specimen of this species on the north coast of Wirral in 1852.

Polycera ocellata, Alder and Hancock.

Frequently taken at Hilbre, Egremont, and elsewhere (Byerley).

Polycera quadrilineata, Müller.

Found at the Isle of Man (Forbes).

Ancula cristata, Alder.

This species is common in this neighbourhood, especially at Hilbre Island. It has been recorded by Price and by Byerley from various points on the coast. It was taken at Hilbre Island on May 17th, June 13th, and July 11th; and was dredged in Hilbre Swash on May 9th.

Specimens fully one inch in length have been found at Hilbre.

Sub-order.—POLYBRANCHIATA.

Family.—TRITONIIDÆ.

Tritonia hombergi, Cuvier.

Forbes dredged large specimens of this species from twenty-five fathoms off the north coast of the Isle of Man. He found two varieties, of which the yellow one was larger than the purple, and attained a size of six inches.

One specimen of this species was found at Hilbre (S. Archer). Byerley records it as having been also found upon the western shore of the Mersey, near the entrance of the river. Mersey and Dee, occasional (Collingwood).

Tritonia plebeia, Johnston.

Dredged north of Wirral (Byerley). Mersey and Dee, occasional (Collingwood).

This species was found on Hilbre Island at low-water mark on May 17th, 1885; and was dredged in Hilbre Swash on May 9th.

Family.—DENDRONOTIDÆ.

Dendronotus arborescens, Müller.

This large and very beautiful species is usually one of the commonest Nudibranchs at Hilbre Island. In mid-winter I have found it in great abundance creeping over the stones and seaweeds close to low-water mark. In some of the L. M. B. C. expeditions to Hilbre, in early summer, on the other hand, very few specimens were found; but later on, in July, *Dendronotus* was again abundant. Mr. Price and Mr. Byerley record it from Hilbre, New Brighton, and Woodside Slip, but say that it is (1855) by no means so abundant as in former years. I am inclined to think that these variations in the abundance of this species at Hilbre are due to a habit of migrating periodically from the shore into deep water. It is intended in future expeditions of the L. M. B. C. to Hilbre Island to make careful observations upon the relative abundance of this and other species.

Recorded from the Isle of Man by Forbes.

This species was dredged during the cruise of the "Hyæna" off the Great Ormes Head, from a depth of seven to eight fathoms, and was obtained during August between Port St. Mary and Spanish Head, Isle of Man, from a depth of twenty fathoms.

Family.—Melibidæ.

Doto coronata, Gmelin.

Taken at Woodside (Price). Mersey and Dee, very common (Collingwood). Isle of Man (Forbes).

This species is not uncommon now at Hilbre Island, although at the time when Byerley's *Fauna* was written it had only been found once in the neighbourhood.

It was dredged in August off the south end of the Isle of Man, near Port Erin.

It was obtained during the cruise of the "Hyæna" off the north end of Puffin Island, from a depth of eleven to thirteen fathoms, on May 24th; it was found at Hilbre Island on June 13th, and was dredged in Hilbre Swash on May 9th.

Doto fragilis, Forbes.

Forbes first found this species off the Manx coast in deep water, and described and figured it in his *Malacologia Monensis* (1838) under the name of *Melibæa fragilis*.

It was dredged during the cruise of the "Hyæna" off the north end of Puffin Island, from a depth of eleven to thirteen fathoms, on May 24th; and also off Port Erin, and between Port St. Mary and Spanish Head, Isle of Man, during August, from depths of fifteen to twenty-five fathoms.

Family.—Proctonotidæ.

Antiopa cristata, Delle Chiaje.

This species is recorded from the Menai Straits by Mr. Alder; and from the Dee by Dr. Collingwood.

Antiopa hyalina, Alder and Hancock.

This rare species was first found in July, 1851, by Mr. Byerley and Mr. Price, junior, who each picked up a single specimen at Hilbre Island. In August, 1854, Mr. Byerley found another fine specimen in the same locality, and sent

it to Mr. Alder for examination and description. The species has since been found at Hilbre Island by Mr. Higgins; and Mr. T. J. Moore informs me that he has also found two specimens there.

It is figured by Byerley in his *Fauna* (p. 46).

Family.—Eolididæ.

Eolis papillosa, Linn.

Recorded by Byerley from Hilbre, Caldy Blacks, New Brighton, &c. The small light-coloured variety formerly described as a distinct species, under the name of *Eolis obtusalis*, by Alder and Hancock, was found by Mr. Byerley at Hilbre and at Egremont. Mr. Price informs me that it used to be found at Woodside slip.

This species has been taken several times during the last year at Hilbre Island.

Eolis glauca, Alder and Hancock.

Dredged off Beaumaris, Menai Straits (Alder and Hancock).

Facelina coronata, Forbes.

Recorded by Byerley from Hilbre Island, Egremont, &c.; and by Price from Seacombe.

This is a common species in the neighbourhood. Sometimes a large number of specimens may be found creeping over the stones at Hilbre Island. It was collected at Hilbre Island on May 17th, and June 13th, 1885.

Flabellina drummondi, Thompson.

Recorded by Byerley as the commonest species of the neighbourhood. Seacombe (Price). Mersey and Dee, very common (Collingwood).

It is frequently found in abundance at Hilbre Island.

Alder and Hancock describe a remarkable variety of this

species from the Menai Straits, opposite Bangor, having the branchial processes of a sage green colour.

Coryphella lineata, Lovén.

Isle of Man (Forbes). Dredged from shallow water, Douglas, Isle of Man (Alder).

Two specimens of this species were dredged during August off Port Erin, Isle of Man, from a depth of fifteen fathoms.

Coryphella gracilis, Alder and Hancock.

Menai Straits (Alder).

One specimen of this rare species was dredged during the cruise of the "Hyæna" off the north end of Puffin Island, from a depth of eleven to thirteen fathoms, on May 24th.

Coryphella landsburgi, Alder and Hancock.

The second specimen known of this rare species was found in 1849, by Mr. Byerley, at Hilbre. Another specimen of probably the same species, but much larger size, was found in the same locality in June, 1853.

Coryphella rufibranchialis, Johnst.

Recorded by Dr. Collingwood as being not uncommon in the Mersey and the Dee.

Cavolina concinna, Alder and Hancock.

"Mersey; common (the second known locality)" (Collingwood).

Cavolina olivacea, Alder and Hancock.

"Dee; once taken" (Collingwood).

Cavolina amœna, Alder and Hancock.

One specimen of this small Eolid was dredged off Port Erin, Isle of Man, in August, 1885, from a depth of fifteen fathoms.

Cavolina aurantiaca, Alder and Hancock.

Mr. Price, Mr. Byerley, and Dr. Collingwood have found this species occasionally at Hilbre, Woodside, New Brighton, &c.

Cavolina arenicola, Forbes.

This species was dredged in 1844 by Prof. Forbes off Anglesey, at the entrance to the Menai Straits, from a depth of ten fathoms, on a weedy bottom.

Cavolina viridis, Forbes.

First discovered by Prof. Forbes on *Antennularia*, dredged from deep water off the Manx coast.

Cuthona nana, Alder and Hancock.

This species was collected on July 11th, 1885, at Hilbre Island, during one of the expeditions of the L. M. B. C.

Galvina picta, Alder and Hancock.

Found occasionally at Hilbre and Egremont (Byerley). Mersey and Dee, not uncommon (Collingwood). Menai Straits (Forbes). Off Red Wharf Bay, May 25th, 1885.

This species was dredged off Port Erin, Isle of Man, in August, from a depth of fifteen fathoms.

Galvina tricolor, Forbes.

Eubranchus tricolor, Forbes, *Malacologia Monensis*, p. 5.

Off Isle of Man, twenty fathoms, and off Anglesey (Forbes).

This large and beautiful species was first found by Prof. Ed. Forbes in September, 1836, off the Manx coast, at a depth of twenty fathoms, and is described and figured in his *Malacologia Monensis* under the name of *Eubranchus tricolor*. Since then it has been found at various places on the west coast, and is not uncommon in the neighbourhood of Lamlash Bay, Arran.

One large specimen was dredged during August, between

Port St. Mary and Spanish Head, Isle of Man, from a depth of twenty fathoms.

Tergipes despecta, Johnston.

Several specimens of this small Eolid were found on June 13th by the L. M. B. C. adhering to Zoophytes at the north end of Hilbre Island, near low-water mark; the small kidney-shaped masses of spawn were abundant. It was found again at Hilbre Island on July 11th.

The species has been recorded from Garth Ferry, Bangor, North Wales, by Alder and Hancock; and from the Mersey by Collingwood.

Tergipes exigua, Alder and Hancock.

This species was found along with the preceding one at Garth Ferry, Bangor, North Wales, by Alder and Hancock. It is also recorded by Dr. Collingwood as being rare in the Mersey.

Embletonia pallida, Alder and Hancock.

This rare species was discovered amongst seaweed on the shore at Birkenhead in the spring of 1854, and sent for description to Messrs. Alder and Hancock.

As the Nudibranchs are not included in the distributional tables of the Mollusca on pp. 247 to 266, a table is here appended showing the distribution of the above noted species in the three parts of the L. M. B. C. district in which they have been collected and recorded. The first column includes Hilbre Island; and the second takes in the entrance to the Menai Straits and the coast of Anglesey.

Probably the greater number of species recorded from the Mersey district is mainly due to that region having been so thoroughly investigated by Mr. Price, Mr. Byerley, Dr. Collingwood, and other naturalists of this neighbourhood.

NUDIBRANCHIATA.	Estuary of the Mersey.	North Wales.	Isle of Man.
Archidoris tuberculata ..	×	×	×
A. johnstoni	×		
A. flammea			×
Lamellidoris bilamellata ...	×		
L. depressa	×		
L. proxima	×		
Acanthodoris pilosa	×		
A. quadrangulata ...	×		
Goniodoris nodosa		×	×
G. castanea			×
Triopa claviger			×
Polycera lessoni	×		
P. ocellata	×		
P. quadrilineata			×
Ancula cristata	×		×
Tritonia hombergi ...	×		×
T. plebeia	×		
Dendronotus arborescens ...	×	×	×
Doto coronata	×	×	×
D. fragilis		×	×
Antiopa cristata	×	×	
A. hyalina	×		
Eolis papillosa	×		
E. glauca		×	
Facelina coronata	×		
Flabellina drummondi ...	×	×	
Coryphella lineata			×
C. gracilis		×	
C. landsburgi	×		
C. rufibranchialis ..	×		
Cavolina concinna	×		
C. olivacea	×		
C. aurantiaca	×		
C. amœna			×
C. viridis			×
C. arenicola		×	
Cuthona nana	×		
Galvina picta	×	×	×
G. tricolor		×	×
Tergipes despecta	×	×	
T. exigua		×	
Embletonia pallida	×		

NOTES on the CEPHALOPODA Collected by the L. M. B. C. during the Summer of 1885.*

By W. E. Hoyle, M.A., M.R.C.S., F.R.S.E.,
NATURALIST TO THE "CHALLENGER" EXPEDITION COMMISSION, EDINBURGH.

Eledone cirrosa (Lamarck), d'Orbigny.

1776. *Sepia octopodia* (?), Pennant, *Brit. Zool.*, vol. iv., p. 58, pl. xxviii, fig. 44.

1799. *Octopus cirrhosus*, Lmk., *Mem. Soc. Hist. Nat. Paris.* t. i, p. 21, pl. i, fig. 2.

1853. *Eledone cirrhosus*, Forbes and Hanley, *Brit. Moll.*, vol. iv, p. 211, pl. KKK, fig. 4; pl. MMM, fig. 1.

1869. *Eledone cirrosa*, Jeffreys, *Brit. Conch.*, vol. v, p. 146. pl. vii, fig. 2.

Two specimens (both females) were placed in my hands for examination, one labelled "Hilbre Island, low water, 1885," the other "Hyæna, May 24, 1885."

This species is the commonest Octopod of the northern British shores, and, indeed, of those of the north-west of Europe generally. The males are distinguished by having the third or ventro-lateral arm of the right side modified into a spoon-shaped copulatory organ. The males should be carefully looked for in future expeditions, because Steenstrup† has described a peculiar modification of the tips of the other arms, which it is very important should be confirmed, because his specimen was not in good condition. The suckers cease a few millimeters from the extremity, and each is replaced by a pair of minute cirri.

* For the complete record of the Cephalopoda see Report on the Mollusca, p. 245.—Ed.

† *K. dansk. Vidensk. Selsk. Skriv.*, Rk. iv, Bd. iv, p. 206, Tav. ii, fig. 6: for translation, see *Ann. Mag. Nat. Hist.*, series 2, vol. xx, p. 102.

This fact would have an important bearing on the question of the identity of this species with the *Eledone aldrovandi* of the Mediterranean, which closely resembles it, but has the tips of the arms like those of *Eledone moschata*.

Eledone Pennantii and *Eledone Aldrovandi* of Macgillivray,* found near Aberdeen, are probably both referable to this species, but the latter is rather doubtful; it cannot, however, be referred with more probability to any other.

Sepiola atlantica, d'Orbigny.

1839. *Sepiola atlantica*, d'Orb, *Céph. acét.*, p. 235; *Sépioles*, pl. iv, figs. 1–12.

1853. *Sepiola atlantica*, Forbes and Hanley, *British Moll.*, p. 217, pl. MMM, fig. 2.

1869. *Sepiola Rondeleti*, Jeffreys, *Brit. Conch.*, vol. v, p. 136 (*pars*).

Three female specimens, labelled "May 24, 1885."

This species has been confused with *Sepiola Rondeléti*, Leach, by most British naturalists; even by one so eminent as the late Dr. Gwyn Jeffreys. He remarks, that "the male [of *S. Rondeléti*] is *Sepiola atlantica* of d'Orbigny," a statement that is absolutely without foundation, as both sexes of both species are known, and both in the present one bear the numerous rows of suckers, on the tips of the ventral arms, which are characteristic of the species.

All the three specimens submitted to me had been preserved in picric acid, a re-agent which, in future expeditions should be avoided for Cephalopoda.

Loligo media (Linné), Thomson.

1767. *Sepia media*, Linn. *Syst. Nat.*, ed. xii, p. 1095.

1799. *Loligo subulata*, Lmk., *Mém. Soc. Hist. Nat. Paris*, t. i, p. 15.

1844. *Loligo media*, Thomson, *Rep. Brit Assoc.*, p. 248.

1849 *Teuthis parva*, Gray, *Brit. Mus. Cat. Moll.*, vol. i, p. 76.

* *Moll. Anim. Scot.*, pp. 31, 32, 1843.

1851. *Loligo marmoræ*, Vér., *Céph. Médit.*, p. 95, pl. xxxvii.
1853. *Loligo marmoræ* and *L. media*, Forbes and Hanley, *Brit. Moll*, vol. iv, p. 228–230, pl. QQQ, figs. 1, 2
1869. *Loligo media*, Jeffreys, *Brit. Conch.*, vol v, p. 132.

Two specimens, labelled "May 25 and 24, 1885," one male, one female.

Of the two specimens examined, one has the caudal extremity produced into a slender tapering process several centimetres long, while in the other it terminates in a point only about one centimetre long; such differences in the form of the body are frequent in this species, and have led previous observers to establish new species based in error on this character. Verany's *Loligo marmoræ*, for example, is only one of the short-bodied individuals, and was recognized by d'Orbigny as a female. It has been suggested that the difference between these two forms is a sexual one, and this is borne out by the two specimens in the present collection, for while the shorter is a female, the longer is a male, and has the ventral arm on the left side modified in the usual way, that is, on the distal half of it the suckers are converted into conical papillæ. Steenstrup,* however, states that he has seen males and females of both long and short forms.

* *Ann. Mag. Nat. Hist.*, ser. 2, vol. xx, p. 87.

REPORT on the TUNICATA of the L. M. B. C. DISTRICT.

By W. A. Herdman, D.Sc., F.L.S.,
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The great majority of the Tunicata discussed in this Report were obtained off the South end of the Isle of Man during August, 1885. A few species were obtained at Penmaenmawr, and during the cruise of the "Hyæna," and three species were found at Hilbre Island. Very few Tunicata have been previously recorded in this district. Byerley, in his *Fauna*, mentions two species of *Ascidia* as having been found at Hilbre Island; and Forbes, in the *Malacologia Monensis*, records five species of Simple Ascidians from the shores of the Isle of Man. In the *British Mollusca* four species of Compound Ascidians, from the same locality, are added to the list. Thus, the previous records in all amount to eleven species.

The present Report deals with forty-seven species, of which at least two are new to science, while seven have not been previously recorded from British seas. Nineteen of the species are Simple Ascidians, twenty-seven are Compound, and the remaining species is the pelagic *Oikopleura flabellum*. I am convinced that, long as this list is, it is still far from complete. The rich Tunicate Fauna of the Manx seas requires a good deal of further investigation before it can be said to be thoroughly known.

LARVACEA.

Family.—Appendiculariidæ.

Oikopleura flabellum, J. Müller.

Appendicularia flagellum, Huxley, *Phil. Trans.*, 1851, part ii, p. 595.

An *Appendicularia*, which apparently belongs to this species, was very abundant on the surface of the sea near Port Erin, Isle of Man, on certain days in July and August. It was taken in the tow-net on July 30th, August 1st, August 7th, August 18th, August 19th, August 21st, and on August 22nd. All the specimens seem to belong to the one species, and they are all of about the same size.

The British species of the Appendiculariidæ have never been critically examined, and they are probably more abundant than is generally supposed.

In 1845, Forbes and McAndrew found a species of *Appendicularia* in abundance off the north coast of Scotland. It gave a red colour to the surface water, and, from Forbes' figure,* it seems to have been unlike any of the known species; it was a short-bodied form with a cleft at the end of the appendage. Huxley, in 1856, † described specimens of *Appendicularia flabellum* which he had obtained in the Bristol Channel, near Tenby. In 1858, Allman found a species of *Appendicularia* in the Firth of Clyde, and Strethill Wright recorded one from the Firth of Forth.‡ Various species from other seas have been described by Gegenbaur, Moss, and Fol. In 1874, Sanders§ described two species, one an *Oikopleura*, and the other a *Fritillaria*, but both apparently new to science, from Torquay harbour.

These are the published records of Appendiculariidæ in British waters. A few years ago Dr. Sorby, F.R.S., sent me a large number of specimens, mostly of the present species, which he had obtained during the cruise of his yacht, "The Glimpse," round the south coast of England; and while dredging during the last few summers on the west coast of

* *British Mollusca*, vol. i, pl. W., fig. 1.
† *Quart. Journ. Micro. Soc.*, vol. iv, p. 181, 1856.
‡ *Proc. R. S. Edin.*, vol. iv, p. 123,
§ *Monthly Microsc. Journ.* vol. xi, p. 141.

Scotland, I have taken Appendiculariidæ in the tow-net at Lamlash Bay, Arran, in Loch Fyne, and in the Sound of Mull. Mr. Thomas Bolton, of Birmingham, informs me that he has found *Appendicularia* (species undetermined) at Brodick Bay, Arran, off the pier at Llandudno, at Tenby, and at Falmouth. Dr. John Lowe writes to me that he found *Appendicularia flabellum* in considerable quantity on various occasions, from 1867 to 1873, in the river Ouse at King's Lynn; Prof. Haddon noticed the genus in Berehaven, on the S. W. coast of Ireland, in the summer of 1885; Mr. W. H. Shrubsole has frequently taken it with the tow-net at Sheerness in 1885, 1884, and some previous summers; and Prof. McIntosh, in answer to a query I sent to *Nature*, states that *Appendicularia* is prevalent in summer and autumn along the east coast of Scotland.

ASCIDIACEA.

ASCIDIÆ COMPOSITÆ.

Family.—Botryllidæ.

Polycyclus savignyi, Herdman.

Botryllus polycyclus, Savigny, *Mém.*, p. 202, 1816.

A large species of *Polycyclus*, which appears to be not uncommon in deep water off the west coast, is, I believe, identical with Savigny's *Botryllus polycyclus*. It is not the same species as *Polycyclus renierii* (= *Botryllus stellatus*, Renier), which has been described by Lamarck, and since by Grube, Della Valle, and von Drasche.* Whether this is the *Botryllus polycyclus*, Sav. (?) of Alder,† is doubtful. He describes it as living under stones within tide marks. My specimens have always been dredged from depths of from five to twenty fathoms.

* See, *Die Synascidien der Bucht von Rovigno*, p. 13, 1883.

† *Cat. Mar. Moll., &c., Trans. Tyneside N.F.C.*, vol. i, p. 111.

This species is undoubtedly a *Polycyclus*.* It forms rounded masses up to five cm. or more in length and breadth, and 1·5 cm. in thickness. These colonies are never incrusting, and are usually very slightly attached to a fragment of seaweed or a Zoophyte. Half a dozen specimens were dredged off Bradda Head, near Port Erin, on July 30th, 1885, from a depth of twenty fathoms, and one colony was dredged off the Halfway Rock, near Port Erin, in August, from a depth of fifteen fathoms. This last specimen had the test of a dark blue colour with brown Ascidiozooids.

Several small colonies attached to *Hydrallmania falcata* and other Zoophytes, which were dredged during the cruise of the "Hyæna," on May 24th, 1885, off Bangor, from a depth of ten fathoms, may possibly belong to this species or to a closely allied one. They are certainly referable to the genus *Polycyclus*, but although the colonies are small, the Ascidiozooids are larger and more conspicuous than in the Manx specimens. The internal structure seems, however, to be much the same in the two cases.

In all the colonies the system of vessels in the test is very well developed, and the terminal bulbs form conspicuous red or brown dots which are clearly visible from the outside. The tentacles are sixteen in number, eight large and eight very small. The pigment masses which are placed in the mantle over the median lateral tentacles in *Polycyclus jeffreysi* are also visible in the Manx specimens. Some of the smallest of the "Hyæna" specimens show pallial budding in various stages, but no stolonial buds were noticed.

Botryllus morio, Giard (?)

I refer to this species, with a certain amount of doubt, a small colony of *Botryllus*, which was found adhering to

* For the characters of the genus, see Herdman, "Challenger" Report, "Tunicata," part ii, 1886.

Algæ in a shore-pool at Port Erin, Isle of Man, on August 25th. Unfortunately, Giard, in most of the new species which he formed, described only the external appearance, and especially the colours; consequently it is almost impossible to identify spirit specimens from his descriptions; and even in the case of living specimens, on account of the great amount of individual variation found in the Botryllidæ it is very desirable to have some anatomical characters to supplement the surface markings.

This species is in external appearance more like *Botryllus morio*, or some of the many allied varieties and species* than any other described form. When living, the colony as a whole was of a dark colour. The test was dull grey, marked with opaque grey or white dots. The Ascidiozooids are not large; there are from six to twelve in a system, and the systems are not crowded. The colour of the Ascidiozooid was darkish brown, with a lighter streak along the centre, and with distinct white tentacles in the branchial siphon, of which three were more conspicuous than the fourth. The margins of the common cloacal apertures are marked with opaque white lines.

Botryllus smaragdus, Milne-Edwards. (Pl. VI, fig. 7.)

One large and several smaller specimens of this species were found on the shore near Port Erin, during August. Giard† states that the specimens of this species which he examined, had the tentacles yellow, and the ends of the vessels in the test also yellow. In the manx specimens (when alive), the tentacles were white, while the vessels had their terminal bulbs (which were particularly large and conspicuous), of a dark green colour. This species is very variable in its colouring, and several tints of green may even be found in the one colony.

* See Giard, *Archives de Zool. expér.*, t. 1, p. 629, 1872.

† *Loc. cit.*, p. 626.

The region at the base of the branchial siphon in this species is shown in Plate VI, fig. 7. The tentacles are of three lengths. There are two of the largest size which are placed laterally, and have masses of pigment cells of a greenish yellow colour at their bases. Those of the next size are also two in number, and are dorsal and ventral in position, while the smallest size consists of a series of four tentacles alternating with the others, but springing from a line placed nearer to the branchial aperture. The dorsal tubercle is small, and is nearly circular in outline (Pl. VI, fig. 7, *d. t.*); there is no distinct peri-tubercular area. At the ventral edge the peripharyngeal band turns very distinctly posteriorly, to become continuous with the edges of the endostyle (see Pl. VI, fig. 7, *en.*)

Botryllus violaceus, Milne-Edwards.

This striking species is fairly common around the south end of the Isle of Man, and it seems to extend further up the shore than any other species of *Botryllus*, or than any other Compound Ascidians, except perhaps some of the species of *Leptoclinum*.

Botryllus violaceus is usually found attached to the under surfaces of large flat stones in tidal pools, and it often forms colonies of very considerable size, several inches in diameter. The colonies are always very thin, and difficult to detach without tearing. The species is very variable in colouring, and Giard * has formed a number of varieties based upon the particular tint of blue and the breadth of the characteristic white lines. Of these the Manx specimens seem to belong to the three varieties, *cyanus*, *scala*, and *nigricans*, and most of them are certainly var. *scala*, which is, I believe, the commonest British form.

This species has not previously been recorded from the locality. I have found it before at Lamlash Bay, in the

* *Arch. de Zool. Expér.*, t. 1, p. 621.

Clyde district, and in the Sound of Mull. The Isle of Man specimens were found on the shore at Port Erin, and at Bay-ny-Carrickey, near Port St. Mary.

Botryllus schlosseri, Pallas.

This species is not uncommon on the shores of the south end of the Isle of Man. It was taken at Port Erin and at Bay-ny-Carrickey, attached to *Fucus*, and under stones near low water mark, and in tidal pools.

Botryllus gemmeus, Savigny.

Recorded by Forbes (*Brit. Moll.*) as having been found by himself at Ballaugh, Isle of Man, adhering to stones at low water.

Botryllus pruinosus, Giard (?).

A few colonies obtained under stones, near low water mark, at Port Erin and Bay-ny-Carrickey, may possibly belong to this species; but, in the absence of any anatomical characters in Giard's description, it is impossible to settle the question definitely.

Botrylloides rubrum, Milne-Edwards.

This species is common around the south end of the Isle of Man. It was found in deep water by dredging off Spanish Head, attached to Algæ and Zoophytes, and also on the shore, attached to Algæ, etc., at Port Erin, and at Bay-ny-Carrickey. It was also collected at Penmaenmawr, by Mr. Thompson, in July.

The Manx specimens show great variation in colour and in the size, both of the systems and also of the Ascidiozooids. The colour most commonly seen is a brilliant scarlet, but yellow tints are also found.

Botrylloides albicans, Milne-Edwards.

A pure white *Botrylloides*, several specimens of which were found at the Isle of Man, appears to belong to

this species. It generally forms small rounded colonies of one or two systems each, which are attached to Algæ and Zoophytes; but one colony of larger size, several centimetres in diameter, and composed of half a dozen systems, was found incrusting the lower surface of a stone in a shore-pool at Port Erin. The other colonies of this species were obtained at Bay-ny-Carrickey, near Port St. Mary, at low tide.

Botrylloides, sp. (?)

A beautiful white *Botrylloides*, one colony of which was obtained at Port Erin incrusting a specimen of *Hydrallmania falcata*, may either be an abnormal specimen of *Botrylloides albicans*, or may possibly be new to science. The systems in this specimen are so ramified and involved that the Ascidiozooids seem to be scattered quite irregularly through the clear and transparent investing mass.

Botrylloides leachii, Savigny (?)

A small purplish species of *Botrylloides*, which was found several times in the neighbourhood of Port Erin, Isle of Man, may possibly belong to this species. The test is clear and transparent, with yellowish vessels; while the Ascidiozooids are of a pale purple tint, and are small and numerous. The specimens were attached to Algæ, near low water mark.

Family.—Distomidæ.

Distoma rubrum, Savigny (?).

A species of *Distoma* forming large rounded colonies is not uncommon at the south end of the Isle of Man attached to *Laminaria*, *Fucus*, and other Algæ, and occasionally to stones near low water mark. It is not so brilliantly coloured as the specimen figured by Savigny,* and in this respect agrees with colonies collected by Mr. W. Thompson in Belfast Bay.† The Manx specimens have the test of a

* *Mémoires*, part ii, pl. iii, fig. 1.

† See Forbes and Hanley, *Brit. Moll.*, v. i, p. 18.

greyish colour, while the Ascidiozooids are red, with whitish markings on the anterior end; the systems are very distinct.

This species was found in shore pools at Port Erin, on *Laminaria* cast ashore near Spanish Head, and at low water mark at Bay-ny-Carrickey. It has not been recorded from the neighbourhood before.

Distoma vitreum, Alder (?).

Two small specimens of a *Distoma*, which were collected in a shore pool at Port Erin, either belong to this species or to one which is undescribed. They are of a grey colour, and semi-transparent, but the surface is somewhat incrusted with minute sand-grains. In other characters they agree with Alder's short description.*

A colony dredged at Port Erin, attached to the inside of a shell, may also possibly belong to this species. It forms several recumbent ovate masses united by a stolon. It is of a pale grey colour, with a good deal of opaque white pigmentation. The Ascidiozooids are small, and, from their structure, evidently belong to the genus *Distoma*.

Distoma sp. (?).

Some specimens of a *Distoma* which were dredged near Port Erin, Isle of Man, from a depth of twenty fathoms, are unlike any species with which I am acquainted, and may possibly be new to science. They form small rounded or pyriform masses, of a clear transparent grey colour, and somewhat incrusted with sand. The body of the Ascidiozooid is short, the alimentary canal projecting very little beyond the branchial sac. In other respects the structure agrees with that of the genus *Distoma*. A more detailed examination of fresh specimens will be necessary before it can be definitely settled whether this is a new species or not.

* *Ann. and Mag. N. H.*, v. xi, 1863.

Family.—Polyclinidæ.

Aplidium fallax, Johnston (?).

A specimen apparently belonging to this species was found by Forbes at the Isle of Man, and figured in the *British Mollusca* (vol. i, pl. A, fig. 1).

Parascidia forbesii, Alder.

Sidnyum turbinatum, Sav., Forbes, *Brit. Moll.*, v. i, p, 14.

Forbes recorded, in the *British Mollusca*, Savigny's species *Sidnyum turbinatum* from the north shore of the Isle of Man, but in the description mentioned that the Ascidiozooids had 8-lobed branchial apertures. This point showed that Forbes' specimen could not be referred to the genus *Sidnyum*, and therefore Alder very properly transferred it to *Parascidia*, and gave it the specific name, *forbesii*. It has apparently not been found since.

Morchellium argus, Milne-Edwards.

Amaroucium argus, Milne-Edwards, "Observations," etc., p, 291.

This species was first described as an *Amaroucium* by Milne-Edwards, in 1842, and was afterwards placed in a distinct genus by Giard, on account of the areolated or irregularly thickened condition of the stomach wall.

It is common around the south coast of the Isle of Man, in deep water. It was dredged during August, 1885, off the Halfway Rock, and Bay Fine, near Port Erin, and off Spanish Head, near Port St. Mary, from depths of fifteen to twenty-five fathoms. The specimens obtained showed a good deal of variation in colour. Some were pale greyish yellow, others orange, and others bright red, and all intermediate conditions were found. Many of the larger colonies were of considerable size, and had long peduncles. In some cases the peduncle was entirely covered with an incrusting layer of sand and shell fragments.

Morchellioides alderi, n. sp. (Pl. VI, figs. 1–4).

External Appearance. The colony is elongated, and is rudely cylindrical in shape. It is attached by the lower part, and the upper end is rounded. The colour is a light semi-transparent grey, sometimes tinged with yellow or pink. The surface is smooth and glistening. The length of the colony is about 1·5 cm., and the greatest breadth about 1 cm.

The Ascidiozooids are conspicuous externally. They are elongated antero-posteriorly, and are not distinctly divided into regions. They are closely placed, and there is no apparent arrangement in systems.

The Test is soft and gelatinous. It is of a light grey colour, and is transparent. The small test cells are very abundant, and present the usual variety in shape.

The Mantle is delicate. The chief muscle bands run longitudinally; they are very distinctly seen on the post-abdomen. The branchial aperture is eight-lobed, and there is a long atrial languet.

The Branchial Sac is very long. The transverse vessels are numerous, and all of the same size. The stigmata are of moderate size, and are arranged with great regularity.

The Alimentary Canal forms rather a short loop. The stomach is large, and its wall is areolated.

This new species is formed for some small colonies (see Pl. VI, figs. 1, 2) of a clear transparent, or in some cases, slightly yellowish Compound Ascidian, which were found in some of the deeper shore pools near Port Erin, and which, on examination, turned out to belong to the genus *Morchellioides*. This group was formed * for some of the new "Challenger" species, and it is characterised by having an eight-lobed branchial aperture, and an areolated stomach, while the post-abdomen is not pedunculated. These characters are all found in the present species (see Pl. VI, fig. 3),

* Report on "Challenger" Tunicata, part ii, p. 176, 1886.

which has probably, if observed at all, been confused with *Amaroucium proliferum*, a species which it closely resembles in external appearance.

The colonies of *Morchellioides alderi* are sometimes ovate or pyriform, with short stout peduncles (Pl. VI, fig. 2), in other cases they are nearly cylindrical. The thorax of the Ascidiozooid is long (Pl. VI, fig. 3), the abdomen is short, and the post-abdomen is very long and slender, it is not separated from the abdomen by any marked constriction. The eight lobes surrounding the branchial aperture are long and pointed (Pl. VI, fig. 3, *br.*). The atrial aperture is placed on the dorsal edge some way back from the anterior end. It is a large rounded opening with a long narrow atrial languet placed upon its anterior margin. There are a large number of rows of stigmata in the branchial sac. The ciliated cells are distinct. The endostyle undulates from side to side in its course (Pl. VI, fig. 3, *en.*).

The œsophagus leads backwards from the posterior end of the branchial sac to the large globular areolated stomach (Pl. VI, fig. 3). The intestine, after running for a short distance posteriorly from the stomach, turns dorsally and then anteriorly to become the rectum, which runs forwards along the dorsal edge of the abdomen and thorax. The post-abdomen is very long and narrow (Pl. VI, fig. 3, *p. ab.*). All the Ascidiozooids in the colonies examined had the male reproductive organs developed, but none showed ova. The vas deferens is long and conspicuous. Its course is somewhat convoluted. Well developed tailed larvæ were found in some of the specimens. They had the single pigmented sense organ placed far back in the body.

This species may possibly be the one briefly described under the name of "*Sidnyum turbinatum*, Sav.?" by Alder, in 1848.* It is certainly not a *Sidnyum*, and so far as I

* *Cat. Mar. Mollusca, &c.*, p. 109.

know Alder did not afterwards re-describe it. Whether it is our species is difficult to say, as Alder's brief description is confined to the external appearance. I have named this Manx *Morchellioides* after Mr. Alder.

Amaroucium proliferum, Milne-Edwards.

A few small colonies of this species were obtained at low water on the shore at Bay-ny-Carrickey, near Port St. Mary, but it is not nearly so common a species here as it is further north, in the Clyde district.

Amaroucium, sp. (?).

A large colony of an *Amaroucium*, differing from all the known British species, was obtained attached to the "roots" of *Laminaria* from Spanish Head, near Port St. Mary, Isle of Man. It forms an incrusting mass of moderate thickness, and was of a rose colour when living. The test is grey and semi-transparent, and the Ascidiozooids are large, and irregularly scattered. The branchial aperture is six-lobed, and there is a long atrial languet. The branchial sac is large and well developed. The tentacles are of at least two sizes, placed alternately. The stomach is folded longitudinally. I hesitate to describe this form as a new species, as it may possibly be identical with one of the species of *Amaroucium* described by von Drasche from the Adriatic.

Family.—Didemnidæ.

Leptoclinum durum, Milne-Edwards.

Leptoclinum aureum, M.-Edw., Forbes, *Brit. Moll*, v. i, p. 17

Several small colonies of this species, which is readily distinguished by its yellow colour, were found attached to the "roots" of *Laminaria*, from near Port St. Mary and Spanish Head, Isle of Man.

Leptoclinum maculosum, Milne-Edwards.

This species is common, chiefly attached to the "roots"

of *Laminaria* and other large Algæ, in shallow water, around the south end of the Isle of Man. Some of the colonies found were beautifully variegated with violet.

It was obtained near Spanish Head, near Port Erin, and at Bay-ny-Carrickey, at low water mark.

Leptoclinum candidum, Savigny (?).

Didemnum candidum, Sav., *Mém.*, p. 194.
Leptoclinum candidum, Della Valle and von Drasche.

A smooth pure white species of *Leptoclinum*, which is common under stones near low water and in tidal pools, may possibly be identical with this species, which has been found in the Gulf of Suez, the Bay of Naples, and the Adriatic. It seems to be distinct from the known British species.

Leptoclinum asperum, Milne-Edwards.

This species is common under stones, near low water mark, and attached to Algæ, at Bay-ny-Carrickey, and near Port Erin, Isle of Man. It varies considerably in colour and thickness.

Family.—Diplosomidæ.

Diplosoma punctatum, Forbes.

Leptoclinum punctatum, Forbes, *Brit. Moll.*, vol. i, p 18.

The species which was described in 1850 by Forbes under the name of *Leptoclinum punctatum*, from specimens which he had obtained at the Isle of Man, is probably a *Diplosoma*, but whether it is a distinct species, or is identical with one of the other known forms of that genus, it is impossible to say from Forbes' brief description. Possibly it may be Giard's *Diplosoma crystallinum*, which is common on some parts of the west coast, or it may be the species described as a *Polyclinum* by Lister, in 1834, and afterwards named *Leptoclinum listerianum* by Milne-Edwards. The species of this genus require to be carefully revised.

Diplosoma gelatinosum, Milne-Edwards.

Didemnum gelatinosum, M.-Edw., "Observations," etc., p. 79.

Colonies of this species were found attached to Algæ and stones at low water mark, and in tidal pools, at Port Erin, and at Bay-ny-Carrickey, Isle of Man.

Diplosoma crystallinum, Giard.

Pseudodidemnum crystallinum, Giard, *Recherches*, etc., p. 656.

This species was obtained attached to Zoophytes, Polyzoa, Algæ, and in some cases to stones, off Port Erin and Port St. Mary, Isle of Man. It is very much more delicate and more transparent than the last species, and the Ascidiozooids are less conspicuous in the investing mass.

A good deal of variation is present in the Manx specimens as to the pigment-cells in the test. In some cases, a large amount of yellow pigment is present; while in other cases the test is free from pigment, and is then perfectly clear and transparent.

ASCIDIÆ SIMPLICES.

Family.—Clavelinidæ.

I use this family in the sense of Milne-Edwards' Ascidiæ Sociales, including *Perophora* as well as *Clavelina*, and allied forms. For reasons which I have given elsewhere,* I regard *Clavelina* as more nearly allied to the Simple than to the Compound Ascidians; by most continental authors, however, the Clavelinidæ are regarded as belonging to the Synascidiæ. In a paper† published recently, Dr. Sluiter, of Batavia, has brought forward additional evidence supporting my view that the genus *Ecteinascidia* forms a transition from *Clavelina* to the Ascidiidæ, and that the

* "Challenger" Exp. Report; Zool., Tunicata, Part I, 1882.

† Ueber einige einfachen Ascidien, &c., *Natuurkundig Tijdschrift v. Nederlandsch-Indie*, Band. xlv, p. 160, 1885.

Clavelinidæ as a whole, are nearer to Simple than to Compound Ascidians.

Two members of this family have been found in the district.

Clavelina lepadiformis, O. F. Müller.

Several colonies of this species were obtained at Hilbre Island, on July 11th, 1885, attached to the under surface of a large stone, just beyond low-water mark. It had not been previously found in this locality.

Forbes recorded it in the *Malacologia Monensis* as being rare at the Isle of Man. Off the south end of the Island, however, it is abundant. It was brought up constantly in the dredge, off the Halfway Rock, and Bay Fine, near Port Erin, and off Spanish Head and Port St. Mary, from depths of ten to twenty-five fathoms. The Ascidiozooids were large and well-formed, the colonies in many cases being very fine. They were generally attached to stones and dead shells.

Several varieties occurred amongst the specimens dredged off Port Erin. The form with two distinct yellow bands around the anterior end of the thorax (Giards' variety *bicincta*), was found. The pigmented bands on the thorax differed greatly in colour. In some specimens they were white (Giards' sub-variety *rissoana* = *Clavelina rissoana* of Milne Edwards ?); in others, pale lemon yellow (the typical form); in others, golden (Giards' sub-variety *auronitens*); and in some, of a rich cinnamon tint. This last form has apparently not been previously noticed; it might be called variety *cinnamomea*. Some specimens have these bands much wider and more distinct than others.

Most of the colonies dredged in August between Port Erin and the Calf were budding profusely, the young buds showing as opaque white knobs of various sizes, upon the transparent creeping stolons. These stolons were in many cases very long and very abundant, and the small gravel

which forms the bottom in some places off Bay Fine, was bound together, to form an irregularly rounded mass, to which the colony adhered by the stolons.

In size, the Ascidiozooids varied from a few millimetres up to 2·5 cm. antero-posteriorly.

Perophora listeri, Wiegmann.

This interesting form was first found on the English coast in 1834, by Lister,* and has since been minutely examined by Giard † upon the coast of Brittany. Some colonies of *Perophora listeri* were dredged during August, 1885, off Spanish Head, near Port St. Mary, from a depth of twenty fathoms. They are attached to Algæ and Zoophytes. This species was dredged by McAndrew and Forbes on the coast of Anglesea, in 1843, but, so far as I am aware, it has not been found in the neighbourhood since.

The branchial sac of this species possesses the peculiarity of having papillæ upon the transverse vessels, like those of *Tylobranchion speciosum*. ‡ I am inclined to regard these papillæ as being rudimentary connecting ducts corresponding to those which bear the internal longitudinal bars in most of the Simple Ascidians.

Family.—Ascidiidæ.

Ciona intestinalis, Linn.

Ascidia intestinalis, Forbes and Hanley, *Brit. Moll.*, v. i, p. 31.

A few specimens of this widely distributed species were dredged off Port St. Mary, and off Port Erin, Isle of Man, from depths of ten to twenty fathoms. A single specimen was found by some members of the L. M. B. C. attached to the under surface of a stone at the north end of Hilbre Island, near low water mark. The species had not been

* *Phil. Trans.*, 1834, part ii, p. 365.

† *Arch. de Zool. Expér.*, t. i, p. 615.

‡ See "Challenger" Report, part ii, p. 157.

previously recorded from the neighbourhood of Liverpool; but Forbes mentions having found it rarely on the Laxey Bank, Isle of Man. It is a very common species further north, on the west coast, in the Clyde district.

Ascidia mentula, O. F. Müller.

Forbes (*Malacologia Monensis*, p. 58) records this large species as being found off the north coast of the Isle of Man.

Ascidia virginea, O. F. Müller.

This common species is the *Ascidia sordida* of Alder and Hancock, and other British authors.* It is recorded by Byerley under that name, as having been found occasionally at Hilbre and dredged in the neighbourhood rarely; and it has been dredged by Edward Forbes off the Manx coast, from a depth of twenty fathoms.

Two large specimens were obtained during the cruise of the "Hyæna," on May 24th, in the Menai Straits opposite Bangor, depth ten fathoms. They are attached to a dead shell, and have rather thin and flaccid tests, giving them somewhat the appearance of *Ciona intestinalis* in the retracted condition.

One of the specimens is noteworthy on account of one of its long slender tentacles being bifurcated at the end. In most other respects, the specimens are normal. The dorsal lamina, however, is rather more distinctly toothed upon the free margin than is usual in the species.

Two smaller specimens (9 mm. and 12 mm. respectively), with more of the ordinary appearance and strength of test, were dredged along with those above described. They are young animals. The larger of them had a specimen of *Modiolaria marmorata*, 3 mm. in length, imbedded in its test on the right side of the body.

* For the synonomy of the species, see Herdman, "Notes on British Tunicata," *Journ. Linn. Soc., Zool.*, vol. xv, p. 279.

A few small specimens of the species were also obtained off Port Erin and Port St. Mary, Isle of Man, from depths of ten to twenty fathoms. One of these, about 1·5 cm. in length, had a *Modiolaria*, fully 5 mm. in length, living in its branchial sac.

Ascidia scabra, O. F. Müller.

Two specimens of this species, one of them rather large, were dredged by Mr. Thompson, off Penmaenmawr, in July, 1885; and several specimens were obtained off Port Erin, Isle of Man, in August. The larger specimen from Penmaenmawr has several small *Modiolaria* imbedded in its test, and several of the Manx specimens are also infested with this Mollusc.

The branchial sac of this species seems particularly liable to variation.* In some parts of the Penmaenmawr specimens the internal longitudinal bars in place of being parallel to the interstigmatic vessels, are inclined at a considerable angle to them, consequently the stigmata cross the meshes obliquely. There is a considerable amount of opaque white pigmentation in the mantle, especially in the walls of the very long branchial siphon. One of the Manx specimens is most brilliantly marked with opaque white and scarlet.

Ascidia elliptica, Alder and Hancock.

This species is recorded by Byerley as having been found at Hilbre three or four times, attached to stones. No description of the species, except Alder and Hancock's account of the external appearance,† has been published, and I have not met with the species at Hilbre. Possibly it is the same as *Ascidia scabra*.

* See Herdman, *Journ. Linn. Soc., Zool.*, vol. xv, pl. xvii, fig. 3.

† *Catalogue of Moll. of Northumb. and Dur., Trans. Tynes. Nat. F. C.*, v. i, p. 107, 1848.

Ascidia aspersa, O. F. Müller.

Ascidia aculeata, Alder, *Ann. and Mag. N. H.*, v. xi, p. 156, 1863.

Several small specimens of this common west coast species were dredged off Port Erin during August. They are decidedly smaller than the usual specimens from Lamlash and Loch Fyne, and the outer surface of the test is not so distinctly roughened. The tentacles, which are small, rather distantly placed, and of three distinct sizes, and the dorsal tubercle * are good, and, so far as my experience goes, fairly constant characters by which the species may be determined. In some of the specimens the internal longitudinal bars of the branchial sac showed a good deal of variation, being frequently incomplete or wanting for several meshes. This was especially the case in the neighbourhood of the dorsal lamina, and of the endostyle.

Ascidia plebeia, Alder. (Pl. VI, fig. 5.)

Several specimens of this species were dredged from a depth of twenty fathoms, off Spanish Head, Isle of Man. It has not been previously recorded from the neighbourhood.

The specimens show considerable variation in the external appearance, one being quite smooth on the surface, nearly transparent, and very much compressed laterally; it is attached by the entire left side to the inner surface of a Lamellibranch shell. Another specimen is only attached slightly by the posterior end of the body, and has the test rough and of a dull green colour; various foreign particles are attached. There is a good deal of variation also in the position and length of the branchial and atrial siphons.

In one of the Manx specimens, the dorsal lamina has long projections from its free edge, opposite the transverse vessels of the branchial sac. It looks much more like a series of languets connected by a slight membrane, than like

* For the shape see Herdman, *Journ. Linn. Soc.*, vol. xv, pl. xvi, fig. 3.

a toothed dorsal lamina (see Pl. VI, fig. 5). The other specimens have the organ in the usual condition.

One of the specimens shows very distinctly the peculiar arrangement of tentacles which I figured in 1880,* and which is rarely seen in the species, viz., the larger tentacles springing from a point distinctly posterior to the line of origin of the smaller series. This specimen has also a good deal of dark brown pigmentation in the prebranchial zone at the anterior extremity of the endostyle, and the greater part of the prebranchial zone is papillated.

Ascidia depressa, Alder and Hancock.

Two specimens of this species were found attached to the under surfaces of stones near low water, on the shore at Bay-ny-Carrickey, Isle of Man. One has the body short, while in the other it is elongated antero-posteriorly. The difference is due chiefly to the size of the branchial siphon, which is in the latter case, drawn out to a great length.

I may add to the description of the internal structure of this species published previously,† that the smaller intermediate papillæ upon the internal longitudinal bars of the branchial sac are not invariably present. In the Manx specimens they are seen in some meshes, and not in others.

Ascidia prunum, O. F. Müller.

Forbes, in his *Malacologia Monensis*, records this species as being frequent on the Manx shores. As it has not been found since, it is possible that Forbes may have confused it with *Ascidia scabra*, or *Ascidia virginea*.

Corella parallelogramma, O. F. Müller.

Ascidia parallelogramma, Forbes and Hanley, *Brit. Moll.*, v. i, p. 34.

Two specimens of this most beautiful species were

* *Journ. Linn. Soc., Zool.*, vol. xv, pl. xix, fig. 4.

† Herdman, *Journ. Linn. Soc., Zool.*, vol. xv., p. 287.

dredged off Spanish Head, near Port St. Mary, from a depth of twenty fathoms; and several were obtained off the Halfway Rock, near Port Erin, from the same depth. The largest specimen is 2·5 cm. in length, and nearly 2 cm. dorso-ventrally. Very much larger specimens are found a little further north on the west coast, at Lamlash Bay, Arran.

This species has not been recorded hitherto either from the neighbourhood of Liverpool or from the Isle of Man.

That peculiarly imperfect condition of the internal longitudinal bars of some parts of the branchial sac, which I first described in 1880 * in this species and another, and which has been found since in a number of other Ascidians belonging to various genera, is seen very well in one of the Manx specimens.

Family.—CYNTHIIDÆ.

Styela grossularia, Van Beneden.

Ascidia grossularia, Van Beneden, *Récherches s. l'Embryogen.*, etc., *des Ascid. Simp.*, p. 61.

This common and widely diffused species was found in abundance during the cruise of the "Hyæna" in the Menai Straits, nearly opposite Bangor, and close to the training ship "Clio," on May 24th, 1885. The depth was ten fathoms, and the bottom muddy. The Ascidians were attached to cinders and dead shells, in some cases in great profusion. The specimens on the shells were mostly small,† and were of the pale depressed blister-like form, but some of those on the cinders were large and of a red colour. Some of the specimens contained many embryos in various stages of development, and completely formed tailed larvæ were present in the peribranchial cavities. This species was also obtained in abundance off Port Erin, off Port St. Mary, and near Spanish Head, at the south end of the Isle of Man,

* "Notes on British Tunicata," *Journ. Linn. Soc., Zool.*, vol. xv., p. 284.

† Some of these were very minute, less than 0·5 mm. in diameter, and were evidently very young.

from depths of ten to twenty-five fathoms. *Styela grossularia* was first described by Van Beneden* from the Belgian coast, but it has since been found in many parts of the British seas. It was obtained from a depth of 363 fathoms in the Faröe Channel, N. W. of Scotland, during the cruise of the "Porcupine," in 1869.† It has not been previously recorded from this neighbourhood.

Polycarpa rustica, Linn. (?)

Cynthia rustica, Forbes and Hanley, *Brit. Moll.*, v. i. p. 39.
Styela rustica, Traustedt, *Oversigt*, &c., *Vid. Medd.*, &c., Kjobnh. 1880, p. 412.

Large numbers of a small red Ascidian were obtained attached to the basal parts of *Laminaria* and other large Algæ, on the shore, and in shallow water near Port St. Mary and Spanish Head, at the south end of the Isle of Man. In all probability they belong to the present species. They agree closely in external appearance with the *Cynthia rustica* of British authors, and in all anatomical details with the descriptions of Kupffer, Traustedt, and others, except in regard to the reproductive organs. The above-mentioned authors both refer to the single tube-like ovaries on each side of the body, while in the Manx specimens the genitalia are in the form of numerous rounded polycarps. The species consequently must belong to the genus *Polycarpa*, and if Kupffer and Traustedt are correct in referring their specimens with elongated ovarian tubes to the *Ascidia rustica* of Linnæus, then my specimens ought to be placed in a distinct species under the genus *Polycarpa*.

Polycarpa comata, Alder.

Cynthia comata, Alder, *Ann. and Mag. N. H.*, 1863, p. 163.
Cynthia ampulla, Forbes and Hanley, *Brit. Moll.*, vol. i. p. 40.
Cynthia comata, Kupffer, *Jahresbericht*, 1875, p. 217.
Styela comata, Traustedt, *Oversigt*, etc., 1880, p. 414.

* *Récherches s. l'Embryog.*, etc., *des Asc. Simp.*
† *Trans. Roy. Soc., Edin.*, vol. xxxii, part ii, p. 223.

One large specimen of this species was dredged off the Halfway Rock, near Port Erin, Isle of Man, from a depth of fifteen fathoms, in August, 1885. It forms an irregular mass, nearly 3 cm. in longest diameter, and the sandy investment is about 8 mm. in thickness in some places.

A smaller specimen from the same locality is probably also referable to this species. Its branchial and atrial siphons are free from sand, and form relatively large clear grey projections. The stigmata in this specimen are relatively larger than in the adult form, but the vessels of the branchial sac have the usual arrangement.

This species has not been previously found in the neighbourhood, unless it is the form recorded by Forbes (*Malacologia Monensis*, p. 57) from the Isle of Man, under the name of *Ascidia* (*Pandocia*) *conchilega*.

Polycarpa pomaria, Savigny.

Cynthia pomaria, Savigny, *Mém. s. l. Anim. s Vert.*, 1816, p. 156.

Cynthia tuberosa, MacGillivray, *Hist. Moll. Aberdeen*, p. 311, 1843.

Polycarpa varians, Heller, *Untersuchung.*, iii Abth, p. 19.

Styela pomaria, Traustedt, *Oversigt*, etc., p. 415.

One large specimen of this widely distributed species was dredged off Bay Fine, near Port Erin, Isle of Man, from a depth of twelve fathoms. It occurs on various parts of the English coast, but has not been previously recorded from this neighbourhood.

The Manx specimen has an abnormal dorsal tubercle. This organ is typically, in this species, of cordate or nearly circular outline, with both horns coiled inwards, and the aperture either on the right side* or the anterior end.† In

* See Kupffer, *Jahresber.*, p. 217.

† See Herdman, Report on the "Triton" Tunicata, *Trans. R. S. Edin.*, vol. xxxiii, part i, p. 96.

the present specimen, the tubercle is of large size (1·5 mm. in diameter). The outline is perfectly circular, and the horns have evidently united on the right side so as to form a ring-shaped structure with no aperture.

Polycarpa monensis, n. sp. (Pl. V, figs. 1–8).

External Appearance.—The shape of the body is transversely ovate, the dorso-ventral diameter being the larger. There is slight lateral compression and the body is not attached. The surface is rough and irregular from the presence of attached stones and other foreign objects. The colour, where the test is visible, is a dull grey. The length of the body (antero-posteriorly) is 1·5 cm.; the breadth (dorso-ventrally) is fully 2 cm.; the thickness (laterally) is 1·2 cm.

The Test is thin but firm. It has shell fragments, and small stones attached firmly to its outer surface. There are no adhering processes. The test matrix is clear and transparent. There are no bladder-cells, and the test-cells are small and inconspicuous.

The Mantle is thin and has the musculature feeble. It is closely adherent to the inner surface of the test throughout. The sphincters are moderately strong. Over the rest of the mantle the muscle fibres run in all directions, and form a close but delicate network.

The Branchial Sac is not very large. Its walls are delicate. There are three or four folds upon each side. Each fold has about five closely placed internal longitudinal bars upon its surface, while there are one or two bars only in each interspace. The transverse vessels are narrow, and all of much the same size. The meshes are square or slightly elongated transversely. Each contains from four to six rather wide stigmata, and is divided transversely by a narrow horizontal membrane. On the right side of the endostyle there are four rows of meshes of which the most ventral is

larger than usual. On the left side of the endostyle there are only three rows before the ventral fold of that side is reached. The stigmata are much wider than the fine longitudinal vessels between them. They are regularly arranged, and have straight sides with rounded ends.

The Endostyle is rather narrow and inconspicuous.

The Tentacles are exceedingly small. They are of two sizes, placed alternately. There are twelve or fourteen larger and the same number of smaller intermediate ones.

The Alimentary Canal is small. The stomach is ellipsoidal, and has slight longitudinal folds. The intestinal loop is narrow.

The Reproductive Organs are in the form of polycarps, partly embedded in the mantle and projecting into the peribranchial cavity.

A single specimen of this new species of *Polycarpa* was dredged on August 1st, 1885, off Port Erin, Isle of Man, from a depth of fifteen fathoms. In external appearance (see Pl. V, fig. 1,) it is rather like one of the Molgulidæ, as the test is incrusted externally with pieces of stone and fragments of shells, etc. There are no branched hairs, the incrusting foreign objects being merely attached to the surface of the test or partly embedded in its substance. The apertures are distinctly visible, and by their quadrangular shape show at once that the Ascidian belongs to the Cynthiidæ, not the Molgulidæ.

The pale grey test is rendered stiff by the attached stones; when these are removed it is weak and flexible. The musculature of the mantle (Pl. V, fig. 4), is not divided into separate layers, as it is in many Cynthiidæ, but merely forms a dense reticulum of very delicate muscle fibres. No definite bundles are formed except on the branchial and atrial siphons. The ectoderm is very distinct (Pl. V, figs. 2, 3).

The branchial sac is notable on account of the large size of the stigmata compared with that of the interstigmatic vessels (Pl. V, fig. 7). The narrow horizontal membranes which divide the meshes transversely, in some places interrupt the stigmata (see Pl. V, fig. 8). On the right side of the branchial sac, there are four longitudinal folds, while on the left side three only are present. The internal longitudinal bars are strong (Pl. V, fig. 7, *i.l*). In some places on the folds they are corrugated.

The small size of the tentacles (see Pl. V, fig. 5), is remarkable, and forms one of the most noteworthy characteristics of the species. There are between twenty and thirty altogether. They are placed far apart, and the two sizes alternate with regularity.

The œsophagus is short (Pl. V, fig. 6, *œ*). It runs ventrally and posteriorly to open into the stomach, which has its long axis directed dorso-ventrally. The intestine runs at first ventrally and then turns anteriorly, then dorsally so as to form a narrow loop. After running along the anterior edge of the stomach, it turns forward to become the long straight rectum, which terminates close to the atrial aperture. The anus (Pl. V, fig. 6, *a*) has a white thickened edge. The polycarps are not numerous. They occur on both sides of the body, and are ovate, and of a pale yellow colour. Each polycarp is hermaphrodite.

Family.—Molgulidæ.

Molgula occulta, Kupffer. (Pl. VI, fig. 6.)

A large number of specimens of the genus *Molgula* were dredged during August, off the south end of the Isle of Man, chiefly between Port Erin and the Calf, and off Spanish Head, from depths of ten to twenty fathoms. They differ considerably in external appearance, some being coated with small stones and fragments of Nullipores and shells, while

others have merely a sandy investment; they all, however, seem to belong to the one species, Kupffer's *Molgula occulta*.* This species has been previously found off the coast of Denmark (Kupffer), at Arendal in Norway (Kupffer), on the coast of Greenland (see Traustedt†), in the Adriatic (Heller‡), and at Torbay§ on the English coast. I have recently seen some specimens of the same species which were dredged last summer by Professor Haddon in Bantry Bay, on the S. W. coast of Ireland.

The Manx specimens vary in size from 0·5 cm. to 3 cm. in extreme length; they are of the usual more or less ovate shape. In the case of one specimen dredged off Bradda Head, near Port Erin, on August 22nd, from a depth of fifteen fathoms, several large colonies of the Hydroid *Clytia johnstoni* were found to be attached to the branchial and atrial siphons. When the Ascidian retracted, and the siphons disappeared under the surrounding sandy test, the Zoophytes were crowded together, and to a certain extent drawn in with the siphons, but this compulsory retraction did not seem to have affected the healthy development of the Zoophytes in the least. Probably it was more than compensated for by the abundant food supply brought within reach of the zooids by the Ascidian's inhalent and exhalent currents.

The branchial sac in the Isle of Man specimens agrees in all respects with the descriptions given by Kupffer, Heller, and Traustedt; the tentacles, however, appear to be usually six large (A), six of median size (B), and twelve small

* Kupffer, *Jahresberichte der Kommission zur Untersuchung der deutschen Meere in Kiel*, Berlin, 1874, vii, Tunicata, p. 224.

† *Oversigt over de fra Danmark og dets nordlige Bilande kjendte Ascidiæ Simplices*, Kjöbenhavn, 1880, p. 427.

‡ *Untersuch. ü. d. Tunicaten d. Adriat. u. Mittelm.* iii, Abth. Wien, 1877.

§ Sorby and Herdman, *Journ. Linn. Soc. Lond., Zool.*, vol. xvi, p. 533, 1882.

(C), arranged with regularity as follows:—A, C, B, C, A. Kupffer and Traustedt describe their specimens as having twelve large and twelve small tentacles placed alternately.

The dorsal lamina in the Manx specimens is usually a plain membrane; the free edge may be irregular, but it is not actually toothed. The dorsal tubercle is very variable. It is usually cordate in outline, and has the aperture placed laterally, or even posteriorly. In one specimen, one of the horns was observed to give off a short curved branch directed inwards (see Pl. VI, fig. 6).

Eugyra glutinans, Möller.

Cynthia glutinans, Möller, *Index Moll., Grönland*, p. 21.
Molgula tubulosa, Forbes, *Brit. Moll.*, v. i, p. 36.
Molgula arenosa, Ald. and Han, *Ann. and Mag. N. H.* 1863, p. 160.
Eugyra arenosa, Hancock, *Ann and Mag. N. H.*, 1870, p. 367
Eugyra glutinans, Traustedt, *Vid. Medd. f. d. Naturh. For. Kjobnh.*, 1880, p. 428.

This widely diffused species is fairly abundant off the Halfway Rock, between Port Erin and the Calf of Man, and also off Spanish Head, Isle of Man, at depths of ten to twenty fathoms. The specimens vary considerably in size, although most of them are small (1 cm. in diameter). They are covered by a light yellowish sandy investment, containing many fragments of shells. The largest specimen was 2 cm. in greatest length.

This species has been fully described by Kupffer * and by Traustedt. † It has been found on the coast of Denmark, Norway, Holland, France, the Faröes, Greenland, Siberia, and at various localities on the English coast. It has not been previously recorded from the Isle of Man.

* *Jahresbericht.*

† *Oversigt over de fra Danmark, etc., Ascidiæ Simplices, loc. cit.*

Explanation of the Plates.

Plate V.

Polycarpa monensis, n. sp.

Fig. 1. Specimen of *Polycarpa monensis*, from side, natural size.

Fig. 2. Ectoderm cells seen in profile, magnified 300 diameters.

Fig. 3. Ectoderm cells, surface view, magnified 300 diameters.

Fig. 4. Part of mantle, magnified 50 diameters.

Fig. 5. Tentacles, magnified 50 diameters.

Fig. 6. Alimentary canal, natural size.

Fig. 7. Part of branchial sac, magnified 50 diameters.

Fig. 8. Small portion of branchial sac, magnified 300 diameters.

Plate VI.

Figs. 1–4. *Morchellioides alderi*, n. sp.

Fig. 5. *Ascidia plebeia*, Alder.

Fig. 6. *Molgula occulta*, Kupffer.

Fig. 7. *Botryllus smaragdus*, M.-Edw.

Fig. 1. Several small colonies of *Morchellioides alderi*, natural size.

Fig. 2. Single larger colony of *Morchellioides alderi*, natural size.

Fig. 3. An ascidiozooid of *Morchellioides alderi*, seen from right side, magnified 50 diameters.

Fig. 4. Small part of the branchial sac of *Morchellioides alderi*, magnified 50 diameters.

Fig. 5. The dorsal tubercle and anterior part of the dorsal lamina of *Ascidia plebeia*, magnified 50 diameters.

Fig. 6. The dorsal tubercle of *Molgula occulta*, an abnormal specimen, magnified 50 diameters.

Fig. 7. The anterior end of an ascidiozooid of *Botryllus smaragdus*, showing the arrangement of the tentacles, &c., magnified 300 diameters.

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a, anus; *at*, atrial aperture; *br*, branchial aperture; *br.f*, fold in branchial sac; *en*, endostyle; *e.gr*, epibranchial groove; *d.l*, dorsal lamina; *d.t*, dorsal tubercle; *gl.d*, duct of neural gland; *i*, intestine; *i.l*, internal longitudinal bar; *l*, dorsal languet; *l.v*, fine longitudinal vessel; *m.f*, muscle fibres; *oe*, oesophagus; *pig*, mass of pigment cells; *p.p*, peripharyngeal band; *p.ab*, post-abdomen; *r*, rectum; *sg*, stigmata of branchial sac; *st*, stomach; *sph*. sphincter; *tn*, tentacles; *tr*, transverse vessels.

PRELIMINARY LIST of the ALGÆ of the L. M. B. C. DISTRICT.

By Alfred Leicester.

The Algæ collected during last summer's expeditions were few, and none of them specially rare. It should be remembered, however, that no particular search was made for Algæ, the primary object of the expeditions being to collect animals. During the coming summer, it is intended to devote some time to a special study of the Algæ of the district, and it is hoped that a detailed report will be ready for the second volume of the Liverpool Marine Biology Committee's series.* In the meantime it is thought desirable to give a list of those species of Algæ which have been already found in the locality. The classification and nomenclature are those of Harvey's "*Phycologia Britannica.*"

Class.—ALGÆ.

Sub-class I.—MELANOSPERMEÆ.

Order I.—Fucaceæ.

Halidrys siliquosa.
Fucus vesiculosus.
Fucus serratus.
Fucus nodosus.

* Mr. F. P. Marrat, who has been working for some years at the seaweeds of the district, will probably also contribute a report upon certain groups of the Algæ.—Ed.

Order II.—Sporochnaceæ.

Desmarestia aculeata.
Desmarestia viridis.

Order III.—Laminariaceæ.

Laminaria digitata.
Laminaria saccharina.

Order IV.—Dictyotaceæ.

Dictyota dichotoma.
Punctaria latifolia.

Order VI.—Ectocarpaceæ.

Cladostephus spongiosus.
Sphacelaria plumosa.

Sub-class II.—RHODOSPERMEÆ.

Order VII.—Rhodomelaceæ.

Polysiphonia formosa.
Polysiphonia fibrillosa.
Polysiphonia fastigiata.
Polysiphonia byssoides.
Dasya coccinea.

Order IX.—Corallinaceæ.

Corallina officinalis.

Order X.—Delesseriaceæ.

Plocamium coccineum.

Order XI.—Rhodymeniaceæ.

Rhodymenia palmetta.

Order XII.—Cryptonemiaceæ.

Chondrus crispus.
Peyssonelia dubyi.
Catenella opuntia.

Order XIII.—Ceramiaceæ.

Ptilota plumosa.
Ceramium rubrum
Griffithsia corallina.
Callithamnion pedicellatum.

Sub-class III.—CHLOROSPERMEÆ.

Order XVI.—Ulvaceæ.

Ulva latissima.

FIRST REPORT on the MARINE FAUNA in the Neighbourhood of PENMAENMAWR.

By Isaac C. Thompson, F.R.M.S.

During the month of July, 1885, I spent a few weeks in the neighbourhood of Penmaenmawr examining the Marine Fauna of the district, by dredging and tow-netting from a boat, and also by collecting on the rocks at low water.

The district explored included the Mouth of the Menai Straits, the sea between the Welsh Coast and Puffin Island (seven miles across), and, in the other direction, towards the Great Ormes Head, as well as the region about Colwyn Bay.

The depth in this locality rarely exceeds four fathoms, and the sea bottom is generally clayey and sandy; patches of round stony masses were occasionally met with.

Near to Puffin Island I dredged over a large mussel bed, a very prolific region, yielding quantities of Zoophytes, the abode of innumerable Amphipoda. A similar mussel bed was passed over at the East side of the Little Ormes Head, near Colwyn Bay.

On one rather stormy day early in July the tow-net yielded a large number of specimens of the *Megalopa* stage of crabs; although they were conspicuously absent from all subsequent tow-net gatherings.

During the whole period tow-net work was much impeded by the abundance of some peculiar gelatinous bodies which were distributed throughout the sea. These little bodies were always distinctly visible on holding a bottle of sea water up to the light. They varied in size from $\frac{1}{12}$ to $\frac{1}{10}$ of an inch in diameter, and were spherical or oblong in form,

the translucent bounding membrane appearing under the microscope to be composed of minute particles with spicules imbedded therein. So completely did the gelatinous mass diffuse itself over the tow-net that it was most difficult to find or pick out any small surface animals.

Although the little gelatinous bodies were quite perfect in form when taken in a bottle, the rush of water into the tow-net always broke them up, the result being a mass of debris (apparently vegetable) which clung tenaciously to the muslin of the net. The gelatinous spheres appeared to be most numerous a few feet below the surface, and were distinctly visible on looking down into the water from the boat side. Weather seemed not to affect them, as they were apparently equally prevalent on calm and on rough days; but it was noticed while rowing across from Penmaenmawr to Puffin Island that they were less plentiful about the middle of the entrance to the Menai Straits than nearer each side. Early in June they were noticed in profusion about the mouth of the Dee, on the "Merry Andrew" expedition.

Associated with these gelatinous bodies were always found quantities of *Noctiluca miliaris*, which were congregated about the surface of the collecting jar, while the gelatinous spheres, if not fractured, remained suspended in the water, and the broken debris from the tow-net fell to the bottom.

These spherical gelatinous bodies are probably Algæ, and they have been noticed previously by several observers on different parts of the coast as occurring at times in very great abundance. In *Nature* for July 16th, 1885, Mr. Shrubsole records having noticed them in quantity on the East coast.

In a paper "On the Movements and Food of the Herring,"* Mr. F. Pearcey describes the occurrence in the

* *Proc. Roy. Phys. Soc*, Edin vol. viii, p. 389.

Shetland Seas of vast banks of *Rhizosolenia shrubsolei*, a marine diatom; and he noticed also what was so conspicuous at Penmaenmawr, namely, the almost total absence of the ordinary surface organisms in the tracts of sea infested by the gelatinous Algæ.

A list of the animals obtained by dredging and shore collecting around Penmaenmawr has been drawn up,* but as this is probably far from complete, it has been thought best to keep it for one of the future volumes, so that at least another season's work might be incorporated with it. The following species may, however, be mentioned as being amongst those which have been collected at Penmaenmawr this year:—

Coryne pusilla, *Thaumantias convexa*, *Aglaophenia pluma*, *Vermilia triquetra*, *Thelepus circinatus*, *Bugula flabellata*, *Amathia lendigera*, *Pycnogonum littorale*, *Botryl-loides rubrum*, *Ascidia virginea*, *Ascidia scabra*, *Styela grossularia*, *Philine aperta*, and *Cypræa europæa*.

* The specimens collected by Mr. Thompson have been distributed to the Authors of the various Reports, and will be found noticed under the groups to which they belong.—Ed.

NOTES on the MARINE INVERTEBRATE FAUNA of the SOUTHERN END of the ISLE OF MAN.

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The shores of the southern end of the Isle of Man are very varied in their characters, and they support an abundant littoral and shallow-water Fauna. Precipitous cliffs extend nearly all the way from Spanish Head to Port Erin, and from Port Erin to Fleshwick Bay; at Port St. Mary, at Bay-ny-Carrickey, and at Port Erin there are sandy or muddy bays enclosed by rocks; in the neighbourhood of Poyllvaaish and of Port St. Mary, long, flat, shelving reefs run out to sea; while at various places stony shores occur, composed of angular fragments broken off from the cliffs and reefs, and forming perhaps the most prolific of all localities to the marine biologist.

Five weeks in July and August, 1885, were spent in exploring this district, and in making collections, chiefly by dredging, tow-netting, and shore work. My headquarters were at Port Erin,* where there is a long narrow bay facing to the west, and enclosed by rocky sides. Most of the dredging was done at the mouth of this bay, at depths of from ten to fifteen fathoms, the bottom being chiefly gravel. Occasional dredging expeditions were carried out further round the coast—to the north, off Bradda Head,* and a little further; and to the south, off Bay Fine* and the Halfway Rock,* and onwards towards the Calf.* One day was spent in dredging off Port St. Mary and off Spanish Head, and around the eastern side of the Calf.

* See Chart, Pl. XII.

The bottom between the Calf and Port St. Mary, at a depth of fifteen to twenty-five fathoms, is almost entirely composed of living Nullipores, in which, however, a rich and varied Fauna is found. In this locality, the following animals amongst others were obtained:—

Leucandra nivea, Halisarca dujardinii.

Garveia nutans, Tubularia simplex.

Adamsia palliata, Corynactis viridis, Polythoa arenacea, Halcampa chrysanthellum.

Sarcodictyon catenata.

Antedon rosaceus, Cribrella sanguinolenta, Ocnus brunneus.

Lineus marinus, Filograna implexa, Hermione hystrix.

Cellaria fistulosa, Cribrilina punctata, Membranipora aurita, Umbonula verrucosa, Porella compressa.

Pagurus prideauxii, Pagurus cuanensis, Eurynome aspera, Ebalia tumefacta.

Lima loscombii, Pecten pusio, Pecten similis, Pecten maximus, Arca tetragona, Pectunculus glycimeris.

Phasianella pullus, Trochus zizyphinus, Fissurella græca, Murex erinaceus.

Doto fragilis, Dendronotus arborescens, Eolis tricolor, Goniodoris castanea.

Clavelina lepadiformis, Perophora listeri, Ciona intestinalis, Ascidia plebeia, Corella parallelogramma, Eugyra glutinans.

Morchellium argus, Botrylloides rubrum.

A large dead valve of *Pecten maximus*, with the following ten species of Polyzoa attached to it, was dredged in this locality:—*Scrupocellaria scruposa, Cellaria fistulosa, Membranipora catenularia, Mucronella peachii, Microporella malusii, Smittia reticulata, Lichenopora hispida, Diastopora patina, Membraniporella nitida, Crisia eburnea.*

In shallower water in this region (between Port St. Mary and the Calf) there are large tracts covered with *Laminaria*,

which are nearly exposed at low water, and from which masses of *Laminaria* are often cast ashore during storms. Attached to the *Laminaria*, especially at the root-like lower ends, are found commonly the following animals :—

Halisarca dujardinii, *Leucandra gossei*.

Harmothoë imbricata, *Filograna implexa*, *Terebella nebulosa*, *Lumbricus capitatus*.

Crisia denticulata, *Crisia cornuta*, *Scrupocellaria scruposa*.

Verruca strömia.

Modiolaria marmorata, *Saxicava rugosa*, *Anomia ephippium*.

Helcion pellucidum, and the variety *lævе*.

Polycarpa rustica.

Amaroucium sp., *Leptoclinum maculosum*, *Diplosoma crystallinum*.

The specimens of *Helcion pellucidum*, var. *lævе*, attain a large size. The Compound Ascidians, especially *Leptoclinum maculosum* and *Diplosoma crystallinum*, are very numerous and form large colonies.

The shore at Kitterland,* immediately opposite the Calf, has a number of deep and well-stocked tidal pools. The rocks are covered by great expanses of a white Nullipore, which must protect the shore to a considerable extent against marine erosion. A brilliant scarlet anemone (*Heliactis venusta*) is common in these pools, and along with it is found a sponge (*Amorphina caruncula*) of precisely the same hue. The result of this association is that it becomes sometimes almost impossible to detect the anemone without a close examination.

The other anemones which were noticed on the shores in the neighbourhood of Port Erin were :—*Actinia equina*, *Anemonia sulcata*, *Tealia crassicornis*, vars. *insignis* and *purpurea*, and *Bunodes gemmaceus*.

* See Chart, Pl. XII.

The rocks on the north-western side of Port Erin, extending outwards towards Bradda Head, form a good collecting ground at low water, and many of the tidal pools are well-stocked, and contain some rare species. A couple of large and well-formed specimens of the rare sponge *Isodictya elegans* were obtained from the bottom of a deep pool lined with Nullipore. Many of the pools are almost choked up with *Corallina officinalis*, attached to which may be found *Asterina gibbosa*, and *Amphiura squamata*. The specimens of *Asterina gibbosa* obtained from the pools at Port Erin were all much smaller than those found on the shore at Bayny-Carrickey, between Port St. Mary and Castletown.

Port Erin is a very good locality for Compound Ascidians. Magnificent specimens of *Morchellium argus* may be obtained from the deeper tidal pools or hanging from ledges of rock near low water mark. Several species of *Leptoclinum* were found attached to stones lying in the rock pools, and a species of *Diplosoma* was not uncommon in similar situations.

In a very limited area, on the northern side of Fleshwick Bay, there are a number of well-stocked tidal pools. Some of these contain quantities of *Corallina officinalis*, in which may be found *Asterina gibbosa*, *Caprella linearis*, *Pephredo hirsuta* (?), *Amphiura squamata*, *Modiolaria marmorata*, *Sycandra compressa*, and *Chthamalus stellatus*.

Large numbers of a beautiful anemone, with a large brown disk, probably a variety of *Actinoloba dianthus*, are found in these pools, generally attached in crevices of the rock from which it is almost impossible to extract them.

Patella vulgata, variety *athletica*, is also very common attached to the rocks at Fleshwick Bay. The specimens are of fair size and of very irregular form. The shell is white and chalky, and the tactile processes of the mantle edge are pure opaque white, and very long.

The only other piece of shore which requires special mention is the flat region, known as Bay-ny-Carrickey, lying between Port St. Mary and Poyllvaaish, near Castletown. Some parts of this beach are wide expanses of sand and sandy mud, with occasional stones and stony pools; while other parts, especially at the Poyllvaaish end, are formed by long low reefs of rock, with many pools and crevices, and overhanging ledges, and well-covered with sea-weed and incrusting animals. *Pleurobranchus membranaceus* is common in this locality, chiefly on the under surfaces of large stones in the pools, along with very fine specimens of *Asterina gibbosa*, much larger than those found at Port Erin. *Trochus zizyphinus* is also common here at low tide.

Compound Ascidians are particularly abundant and large. The following species were collected :—

Botryllus violaceus, Botryllus schlosseri, Botryllus pruinosus, Botrylloides rubrum, Botrylloides albicans.

Distoma rubrum.

Amaroucium proliferum.

Leptoclinum maculosum, Leptoclinum asperum.

Diplosoma gelatinosum.

Some projecting masses of hard clay which occur on one part of this shore, are penetrated in all directions by the burrows of *Pholas crispata*, and those of a small Annelid. Under the stones in the more muddy parts, *Cirratulus borealis* is common; while in the cleaner regions and in the rock-pools, *Nereis pelagica* and *Harmothoë imbricata* are found. Amongst the other species obtained on this shore, were :—*Halisarca dujardinii, Leucandra nivea, Amorphina panicea, Anemonia sulcata, Bunodes gemmaceus, Polynoë floccosa*, and *Galathea squamifera.*

The most prolific dredging ground in the neighbourhood of Port Erin was found to be in front of Bay Fine and the Halfway rock, between the breakwater and the Calf. Here,

at a short distance from the shore, on a bottom composed of stones and sea-weed and dead shells, the following animals were found to be abundant :—*Antennularia ramosa, Plumularia pinnata, Antedon rosaceus, Echinocyamus pusillus, Pectinaria belgica, Terebella nebulosa, Galathea intermedia, Stenorhynchus rostratus, Pectunculus glycimeris, Velutina lævigata, Trochus magus, Aplysia punctata, Morchellium argus, Clavelina lepadiformis, Ciona intestinalis, Corella parallelogramma, Styela grossularia, Eugyra glutinans,* and *Molgula occulta.*

The following rarer forms were obtained once or twice in the same locality :—*Halisarca dujardinii, Halcampa chrysanthellum, Thyone papillosa, Cucumaria hyndmanni, Hermadion assimile* (on the peristome of *Echinus esculentus*), *Hermione hystrix, Carinella lineata, Amathia lendigera, Crangon sculptus, Ebalia cranchii* and *E. tuberosa, Inachus dorsettensis, Trivia europæa, Doto fragilis, Eolis picta, Eolis amœna, Eolis lineata, Polycyclus savignii, Polycarpa monensis,* n.sp.

The tow-net was used on most days, generally in the neighbourhood of Port Erin. On some few days, when it was too rough to dredge, it was possible to work the tow-net in the more sheltered parts of Port Erin Bay. Whenever the tow-net gathering was at all good, or seemed to shew any peculiar organisms, it was preserved in the following manner for future examination :—The tow-net on being brought on board was turned inside out into a wide-mouthed gallon jar of sea water, in which the organisms could be roughly examined with a pocket lens. A few grains of solid picric acid was then added, so as to kill and precipitate the organisms. A great difference was noticed in the amount of picric acid which the different kinds of animals were able to withstand. All the larvæ, the Medusoid Gonophores, and the Sagittæ die first, while the Crustacea are still quite lively

and active ; then, on the addition of more picric acid, the Copepoda stop swimming and fall to the bottom, leaving *Evadne* and any higher Crustaceans, such as Amphipoda and Isopoda, still alive and able to swim about in the picric solution. After all the organisms have been killed and have fallen to the bottom, the superjacent fluid may be poured off so as to reduce its amount, and what remains along with the organisms may then be transferred to a small (1 or 2-oz.) bottle. Then, after settling for a few minutes the greater part of the picric acid solution may be again poured off, and the bottle filled up with alcohol. This process gave fairly good results. The animals were thoroughly preserved, and in most cases had not suffered from excessive or irregular contraction. The previous hardening in picric acid appears to prevent them from being shrivelled by the alcohol. The natural colour, however, is in all cases entirely obliterated as everything is stained opaque yellow by the picric acid.

The following lists have been drawn up* from the tow-net gatherings which were preserved. They shew that, although a slight difference was present in the surface fauna on different days, and at different times, still no definite relation can be established between the time of day, the state of the sea, or the meteorological conditions on the one hand, and the abundance or nature of the surface life on the other :—

I.—July 30th, Port Erin, mid-day.

Peridinium tripos, few.
Thaumantias, many.
Pleurobrachia pileus, few.

* I have to acknowledge the help of Mr. J. A. Clubb, the assistant in the Zoological Laboratory of University College, Liverpool, in making these lists. Mr. Clubb went carefully through the whole of the material, picked out and mounted the species, and identified many of them.—Ed.

Plutei (both Echinid and Ophiurid), many.
Annelid larvæ (*Polynoe ?*), many.
Sagitta bipunctata.
Copepoda, numerous (*Dias longiremis, Calanus finmarchicus,* and *Oithona spinifrons*).
Nauplei, few.
Zoeæ, and other Crustacean larval forms.
Evadne nordmanni, numerous.
Oikopleura flabellum, very few.

II.—July 30th, Port Erin, evening, sea calm.

Peridinium tripos, few.
Annelid larvæ, several kinds.
Sagitta bipunctata, few.
Polyzoon larvæ ? (cf. Mitraria).
Copepoda, very numerous (*Calanus finmarchicus, Metridia armata, Dias longiremis,* etc.)
Nauplei.
Zoeæ, numerous.
Evadne nordmanni, many.
Gastropod larvæ, few.
Oikopleura flabellum, very few.

III.—Aug. 1st, Port Erin, mid-day.

Peridinium tripos, and *P. furca.*
Diatoms, various species.
Thaumantias thompsoni, many; and *T. lucida.*
Bougainvillia britannica.
Pleurobrachia pileus, few.
Echinopædia, few.
Tomopteris onisciformis, one.
Sagitta bipunctata.
Nauplei.
Zoeæ.

Copepoda, numerous (*Calanus finmarchicus, Metridia armata, Dias longiremis, Temora longicornis*, etc.).

Evadne nordmanni, numerous.

Amphipod, one.

Oikopleura flabellum.

IV.—Aug. 7th, Port Erin, mid-day.

Peridinium tripos, a few.

Medusoid gonophores, numerous; several species.

Sagitta bipunctata.

Copepoda, numerous (*Calanus finmarchicus, Metridia armata*, etc.).

Evadne nordmanni, few.

Nauplei.

Zoeæ.

Amphipoda, several species.

Oikopleura flabellum, few.

V.—Aug. 18th, inside the breakwater, Port Erin, noon.

Peridinium tripos.

Medusoid gonophores, several species of *Thaumantias.*

Sagitta bipunctata.

Copepoda, few.

Evadne nordmanni.

Oikopleura flabellum, few.

VI.—Aug. 19th, inside the breakwater, Port Erin, noon.

Medusoid gonophores, numerous (*Thaumantias thompsoni*, and *Thaumantias octona*).

Plutei.

Sagitta bipunctata.

Copepoda, fairly numerous (*Calanus finmarchicus, Pseudocalanus elongatus, Temora longicornis, Centropages hamatus*, etc.).

Zoeæ.

Evadne nordmanni, a few.

Oikopleura flabellum.

Ascidian larvæ.

VII.—Aug. 21st, inside breakwater, Port Erin.

Peridinium tripos, very few.

Medusoid gonophores, very many (*Thaumantias hemispherica*, *T. octona*, *T. thompsoni*, and *Bougainvillia britannica*).

Echinopædia, a few.

Annelid larvæ.

Sagitta bipunctata.

Copepoda, fairly numerous (*Calanus finmarchicus*, *Dias longiremis*, *Temora longicornis*, *Centropages hamatus*, etc.).

Evadne nordmanni, few.

Isopoda, several.

Zoeæ and other larval Crustaceans.

Oikopleura flabellum, very numerous.

VIII.—Aug. 22nd, Port Erin, noon; stiff breeze.

Peridinium tripos, few.

Medusoid gonophores, numerous (*Thaumantias hemispherica*, *T. thompsoni*, *T. octona*, and *Bougainvillia britannica*).

Plutei, few.

Sagitta bipunctata, numerous, and of very large size, up to 16 mm. in length.

Copepoda, fairly numerous (*Calanus finmarchicus*, *Dias longiremis*, *Centropages hamatus*, etc.).

Nauplei and Zoeæ.

Evadne nordmanni, few.

Isopoda, several species.

Oikopleura flabellum, fairly numerous.

IX. Aug. 22nd, Port Erin, after sunset; windy.

Medusoid gonophores.

Sagitta bipunctata.

Tomopteris onisciformis.

Copepoda, various (including *Pleuromma abdominale*, one specimen).

Evadne nordmanni.

Isopoda.

Oikopleura flabellum.

The following is the list of species in the collection made on the Southern shores of the Isle of Man, from Fleshwick Bay* to near Castletown, by shore-collecting, dredging, and tow-netting, during five weeks in July and August, 1885.

Porifera.

Halisarca dujardinii, off Port St. Mary; also shore, Port Erin, Bay-ny-Carrickey, &c.

Chalina limbata, shore, Port Erin.

Dictyocylindrus stuposus, off Port Erin.

Amorphina panicea, shore, Port Erin, &c.

Amorphina caruncula, shore pools, Kitterland.

Isodictya elegans, in shore-pool, Port Erin.

Isodictya densa, Port Erin.

Halichondria incrustans, shore, Bay-ny-Carrickey.

Cliona celata, off Port Erin, and off Spanish Head.

Hymeniacidon sanguinea, shore pools, Port Erin.

Ascetta coriacea, shore, Bay-ny-Carrickey and Port Erin.

Sycandra compressa, shore, Fleshwick Bay, Port Erin, etc.

Sycandra ciliata, shore, Port Erin.

Sycandra aspera, n.sp., off Port Erin.

Leucandra nivea, off Spanish Head, twelve to twenty fathoms.

Leucandra fistulosa, shore, Port Erin.

* See Chart Pl. XII.

Leucandra johnstonii, shore, Bay-ny-Carrickey and Port Erin.

Leucandra gossei, off Port St. Mary, &c.

Cœlenterata.

Hydromedusæ.

Clava multicornis, on *Corallina officinalis*, Port Erin.

Coryne sp., on wood of old breakwater, Port Erin.

Garveia nutans, off Spanish Head, fifteen fathoms.

Tubularia indivisa, dead, off Spanish Head and Port Erin.

Tubularia simplex (?) off Spanish Head, fifteen fathoms.

Eudendrium ramosum, off Port Erin, ten to twenty fathoms.

Eudendrium capillare (?), on *Hyas coarctatus*, off Port Erin.

Clytia johnstoni, off Bradda Head, near Port Erin.

Obelia flabellata, off Port Erin.

Obelia dichotoma, off Port Erin.

Obelia gelatinosa (?), Port Erin.

Campanularia volubilis, off Spanish Head.

Campanularia verticillata, off Port St. Mary, fifteen fathoms.

Campanularia hincksii, off Spanish Head.

Campanularia caliculata, off Port Erin.

Campanularia angulata, off Port Erin.

Campanularia flexuosa, off Port Erin.

Campanularia neglecta, off Port Erin.

Gonothyræa lovéni, off Port Erin.

Lafoëa dumosa, off Spanish Head, ten to twenty fathoms.

Calycella syringa, off Port Erin.

Coppinia arcta, off Spanish Head; shore, Port Erin.

Halecium halecinum, off Spanish Head and Port Erin, ten to twenty fathoms.

Halecium beanii, off Spanish Head.
Sertularella polyzonias, off Port Erin.
Diphasia rosacea, on *Tubularia*, off Port Erin.
Sertularia abietina, off Spanish Head.
Sertularia operculata, off Spanish Head.
Sertularia pumila, shore, Port Erin.
Sertularia filicula, off Port Erin.
Sertularia argentea, off Port Erin.
Hydrallmania falcata, off Spanish Head.
Plumularia pinnata, off Port Erin, fifteen fathoms.
Antennularia ramosa, off Port Erin.
Antennularia antennina, off Spanish Head.

Medusoid Gonophores.

Thaumantias hemispherica, surface, Port Erin.
Thaumantias octona, surface, Port Erin.
Thaumantias thompsoni, surface, Port Erin.
Thaumantias lucida, surface, Port Erin.
Bougainvillia britannica, surface, Port Erin.

Ctenophora.

Pleurobrachia pileus, surface, Port Erin.

Actiniaria.

Halcampa chrysanthellum (?), off Halfway Rock, Port Erin, ten fathoms.

Actinoloba dianthus, shore, Port Erin, Fleshwick Bay.

Heliactis venusta, shore, Kitterland, in rock pools.

Adamsia palliata, off Spanish Head, ten to twenty fathoms.

Actinia equina, Port Erin, Fleshwick Bay, etc.

Anemonia sulcata, shore, Bay-ny-Carrickey, Port Erin.

Tealia crassicornis, shore, Port Erin. The varieties *insignis* and *purpurea* were also noticed.

Bunodes gemmaceus, shore, Bay-ny-Carrickey; shore, Port Erin.

Corynactis viridis, off Spanish Head and The Calf, fifteen to twenty-five fathoms. The specimens seemed to belong to the variety *rhodoprasina*, Gosse.

Polythoa arenacea, off Spanish Head, ten to twenty fathoms.

Alcyonaria.

Alcyonium digitatum, off Spanish Head, ten to twenty fathoms.

Sarcodictyon catenata, off Spanish Head, ten to twenty fathoms.

Echinodermata.

Antedon rosaceus, off Port Erin, Halfway Rock; off Spanish Head, ten to twenty fathoms. Pentacrinoid larvæ on Algæ in same locality.

Asterias rubens, off Port St. Mary.

Cribrella sanguinolenta, off Spanish Head and Port Erin.

Solaster papposa, off Port Erin.

Asterina gibbosa, shore, Bay-ny-Carrickey, Port Erin, etc.

Ophioglypha ciliata, off Port Erin.

Ophioglypha albida, off Port Erin, Port St. Mary, etc.

Amphiura squamata, Port Erin, Fleshwick Bay, etc.

Ophiopholis aculeata, off Port Erin, twelve fathoms, etc.

Ophiothrix pentaphyllum, off Spanish Head, common.

Ophiocoma nigra, off Spanish Head, fifteen to twenty fathoms.

Echinus miliaris, off Spanish Head and Port Erin.

Echinus esculentus, common off Port Erin, Port St. Mary, etc.

Echinocardium flavescens, off Bradda Head, fifteen fathoms.

Echinocardium cordatum, off Port Erin.

Spatangus purpureus, one specimen, off Port Erin, fifteen fathoms.

Echinocyamus pusillus, off Bradda Head, etc., Port Erin; off Spanish Head.

Thyone papillosa, off Cassells, Port Erin, fifteen fathoms.

Ocnus brunneus, off Spanish Head, fifteen fathoms.

Cucumaria hyndmanni, off Port Erin, twenty fathoms.

Vermes.

Leptoplana sp., off Port Erin, ten fathoms.

Leptoplana sp., Port St. Mary, five fathoms.

Carinella linearis, off Port Erin.

Lineus marinus, between Port St. Mary and Spanish Head, twenty fathoms; also, Bay Fine, ten fathoms.

Sagitta bipunctata, surface, Port Erin.

Hermione hystrix, off Halfway Rock, Port Erin, and off Spanish Head, fifteen to twenty fathoms.

Sthenelais zetlandica, Port Erin, twenty fathoms.

Polynoe squamata, off Spanish Head.

Polynoe floccosa, Port St. Mary, five fathoms; Bay-ny-Carrickey.

Hermadion assimile, on *Echinus*, off Bay Fine, ten fathoms.

Harmothoë haliæti, Port Erin, fifteen fathoms.

Harmothoë imbricata, shore, Bay-ny-Carrickey, etc.

Nephthys longisetosa, Port Erin.

Syllis armillaris, Port Erin.

Nereis pelagica, shore, Bay-ny-Carrickey, etc.

Nereis viridis, shore, Bay-ny-Carrickey, and off Spanish Head.

Lumbriconereis fragilis, Port St. Mary.

Eunice sp., Port St. Mary.

Terebella conchilega, Port St. Mary, five fathoms; etc.

Terebella nebulosa, off Port Erin, etc., ten to twenty fathoms; common.

Dasychone lucullana, Port Erin.

Pectinaria belgica, off Port Erin, twenty fathoms.

Filograna implexa, off Port St. Mary, five fathoms.

Cirratulus cirratus, off Port St. Mary.

Cirratulus borealis, shore, Bay-ny-Carrickey, Port Erin, etc.

Serpula vermicularis, off Spanish Head, Port Erin, etc.

Spirorbis borealis, Fleshwick Bay, etc.

Protula protensa, off Spanish Head, twenty fathoms.

Tomopteris onisciformis, surface, Port Erin.

Polyzoa.

Ætea recta, off Port Erin, ten to fifteen fathoms.

Ætea truncata, on Algæ, Port Erin, ten to fifteen fathoms.

Eucratea chelata, var. *elongata*, nov., off Port Erin.

Scrupocellaria scrupea, Port Erin, five to ten fathoms.

Scrupocellaria scruposa, Port St. Mary, five fathoms.

Scrupocellaria reptans, on *Pecten*, etc., off Port Erin.

Bugula plumosa, Port Erin.

Beania mirabilis, Port Erin, five to ten fathoms.

Cellaria fistulosa, off Spanish Head. etc., common, ten to twenty fathoms.

Cribrilina punctata, on decayed wood, Spanish Head, fifteen fathoms.

Membraniporella nitida, on *Pecten*, off Spanish Head, twenty fathoms.

Membranipora catenularia, off Port Erin.

Membranipora aurita, on decayed wood, Spanish Head, fifteen fathoms.

Membranipora pilosa, off Port St. Mary, five fathoms, etc.

Microporella malusii, on *Pecten*, off Spanish Head, twenty fathoms.

Schizoporella spinifera, off Port Erin, ten to fifteen fathoms.

Umbonula verrucosa, off Port St. Mary, and near Spanish Head.

Porella compressa, off Spanish Head, twenty fathoms.

Smittia reticulata, on *Pecten*, off Spanish Head, twenty fathoms.

Mucronella peachii, on *Pecten*, off Spanish Head, twenty fathoms.

Mucronella coccinea, on *Pecten*, off Spanish Head, twenty fathoms; also on *Laminaria* roots, and on *Anomia*, Port St. Mary, common.

Cellepora pumicosa, off Spanish Head.

Crisia eburnea, off Spanish Head, ten to twenty fathoms.

Crisia denticulata, off Port St. Mary.

Crisia cornuta, Port St. Mary, five fathoms; shore, Port Erin.

Diastopora patina, on *Pecten*, off Spanish Head, twenty fathoms.

Lichenopora hispida, on *Pecten*, off Spanish Head, twenty fathoms.

Alcyonidium hirsutum, off Port Erin, ten to fifteen fathoms.

Flustrella hispida, Port Erin, etc.

Amathia lendigera, off Cassells, Port Erin, twelve fathoms.

Bowerbankia imbricata, on base of *Amaroucium*, Port Erin.

Bowerbankia pustulosa, off Port Erin, ten to fifteen fathoms.

Cylindrœcium dilatatum, Port Erin, ten to fifteen fathoms

Valkeria uva, var. *cuscuta*, Port Erin.

Mimosella gracilis, off Bay Fine, ten to fifteen fathoms.

Pedicellina gracilis, and also var. *nodosa*, nov., off Bay Fine.

Crustacea.

Cirripedia.

Verruca strömia, on *Laminaria*, Spanish Head.

Balanus balanoides, off Port St. Mary, very large.

Chthamalus stellatus, shore, Fleshwick Bay.

Copepoda.

Calanus finmarchicus, surface, Port Erin.

Pleuromma abdominale, surface, Port Erin.

Metridia armata, surface, Port Erin.

Pseudocalanus elongatus, surface, Port Erin.

Candace truncata (?), surface, Port Erin.

Dias longiremis, surface, Port Erin.

Temora longicornis, surface, Port Erin.

Centropages hamatus, surface, Port Erin.

Oithona spinifrons, surface, Port Erin.

Ascidicola rosea, in Ascidian, Port Erin.

Amphipoda.

Iphimedia obesa.

Atylus swammerdamii.

Atylus gibbosus.

Dexamine spinosa.

Gammarus locusta.

Gammarus marinus.

Amphithoë podoceroides.

Podocerus falcatus.

Podocerus pelagicus.

Podocerus pulchellus.

Sunamphithoë hamula.

Caprella linearis, shore, Fleshwick Bay.

Proto pedata.

Protella phasma.

Chelura terebrans, great number in wood of old breakwater, Port Erin.

ISOPODA.

Idotea linearis, Port Erin, etc.

PODOPHTHALMATA.

Crangon sculptus, off Port Erin.

Galathea intermedia, off Port Erin, ten fathoms, common.

Galathea squamifera, off Spanish Head, ten to twenty fathoms; shore, Bay-ny-Carrickey.

Pagurus bernhardus, off Port Erin, etc., common.

Pagurus prideauxii, off Port St. Mary.

Pagurus cuanensis, off Spanish Head.

Porcellana longicornis, off Port St. Mary.

Pinnotheres pisum, off Spanish Head, ten to twenty fathoms.

Portunus pusillus, shore, Port Erin.

Ebalia cranchii, off Port Erin.

Ebalia tuberosa, off Port Erin.

Ebalia tumefacta, between Port St. Mary and Spanish Head, twenty fathoms.

Inachus dorsettensis, off Port Erin.

Hyas araneus, off Port Erin.

Hyas coarctatus, off Spanish Head.

Stenorhynchus rostratus, off Port Erin, ten fathoms.

Eurynome aspera, off Spanish Head, twenty fathoms.

PYCNOGONIDA.

Pallene brevirostris, off Spanish Head.

Phoxichilidium femoratum, Port Erin.

Pephredo hirsuta (?), off Port Erin, fifteen fathoms; shore, Fleshwick Bay.

Phoxichilus spinosus, off Port Erin, fifteen fathoms.

Mollusca.

Anomia ephippium, off Spanish Head, Port St. Mary, etc.

Ostrea edulis, off Port St. Mary, ten to twenty fathoms.

Mytilus edulis, off Port St. Mary

Mytilus modiolus, off Spanish Head.

Modiolaria discors, shore, Fleshwick Bay, Port Erin.

Modiolaria marmorata, off Spanish Head, ten to twenty fathoms.

Lima loscombii, off Spanish Head.

Lima elliptica, off Spanish Head.

Pecten varius, young, Port Erin.

Pecten similis, off Spanish Head.

Pecten pusio, off Spanish Head.

Pecten opercularis, off Port St. Mary, etc.

Pecten maximus, off Spanish Head.

Pecten tigrinus, var. *costata*, off Spanish Head.

Nucula nucleus, off Spanish Head, fifteen fathoms.

Pectunculus glycimeris, off Port Erin and Halfway Rock, off Spanish Head, etc., ten to twenty fathoms.

Arca tetragona, off Spanish Head.

Venus fasciata, Port Erin.

Venus casina, Port Erin, Port St. Mary, ten to twenty fathoms.

Venus gallina, Port Erin.

Venus exoleta, off Port Erin.

Astarte sulcata, off Port Erin.

Mactra solida, and var. *elliptica*, off Port Erin.

Tapes virgineus, off Spanish Head.

Saxicava rugosa, off Port St. Mary, Spanish Head, etc.

Psammobia tellinella, off Spanish Head.

Tellina balthica, off Port Erin.

Cardium norvegicum, off Port Erin, young.

Thracia prætenuis, off Port Erin.

Pholas crispata, shore, Bay-ny-Carrickey.

Chiton cancellatus, off Port Erin.

Chiton albus, Port Erin.

Chiton cinereus, off Spanish Head.

Chiton lævis, Port Erin.

Dentalium entale, off Spanish Head, twenty fathoms.

Patella vulgata, common everywhere.

Patella vulgata, var. *athletica*, Fleshwick Bay.

Helcion pellucidum, var. *læve*, off Port St. Mary.

Emarginula fissura, off Port Erin, ten to fifteen fathoms; off Spanish Head.

Fissurella græca, off Port Erin, off Spanish Head, fifteen to twenty fathoms.

Trochus zizyphinus, off Port Erin, fifteen fathoms.

Trochus cinerarius, off Spanish Head; shore, Bay-ny-Carrickey.

Trochus magus, off Port Erin, ten to twenty fathoms.

Trochus tumidus, off Spanish Head.

Purpura lapillis, Fleshwick Bay.

Lacuna divaricata, shore, Bay-ny-Carrickey.

Littorina obtusata, Fleshwick Bay.

Littorina littoralis, Port Erin, etc.

Velutina lævigata, off Port Erin.

Phasianella pullus, off Spanish Head, fifteen fathoms.

Buccinum undatum, off Spanish Head.

Murex erinaceus, off Spanish Head.

Natica catena, off Spanish Head.

Natica alderi, off Spanish Head.

Fusus gracilis, off Spanish Head.

Fusus antiquus, off Spanish Head.

Trophon barvicensis, off Port St. Mary.

Trophon muricatus, off Port Erin.

Pleurotoma nebula, off Port Erin.

Pleurotoma turricula, off Spanish Head.

Cypræa europæa, off Port Erin and Port St. Mary.

Aplysia punctata, off Cassells, Halfway Rock, Bay Fine, Port Erin, etc., ten to twenty fathoms.

Pleurobranchus membranaceus, shore, Bay-ny-Carrickey.

Doris tuberculata, shore, Port Erin.

Eolis lineata, two specimens, dredged off Port Erin, ten fathoms.

Eolis picta, off Port Erin.

Eolis amœna, one specimen, off Halfway Rock, Port Erin.

Eolis tricolor, off Spanish Head, twenty fathoms.

Doto fragilis, off Port Erin; off Spanish Head.

Dendronotus arborescens, off Spanish Head, twenty fathoms.

Goniodoris castanea, off Spanish Head, twenty fathoms.

Tunicata.

Molgula occulta, many, dredged off Bradda Head, fifteen fathoms; off Spanish Head, twenty fathoms.

Eugyra glutinans, off Spanish Head, and off Half-way Rock, ten to twenty fathoms.

Polycarpa monensis, n.sp., off Port Erin, fifteen fathoms.

Polycarpa pomaria, Bay Fine, twelve fathoms.

Polycarpa comata, off Halfway Rock, Port Erin.

Polycarpa rustica, on *Laminaria*, Port St. Mary, five fathoms.

Styela grossularia, off Port Erin, Port St. Mary, Spanish Head.

Corella parallelogramma, off the Cassells, Port Erin, fifteen fathoms; off Spanish Head.

Ascidia depressa, shore, Bay-ny-Carrickey.

Ascidia plebeia, off Spanish Head, twenty fathoms.

Ascidia aspersa, off Port Erin, ten to fifteen fathoms.

Ascidia virginea, off Port Erin, ten fathoms.

Ascidia scabra, off Port Erin, ten to fifteen fathoms.

Ciona intestinalis, off Port Erin, ten fathoms; off Spanish Head.

Perophora listeri, off Spanish Head, twenty fathoms.

Clavelina lepadiformis, off Bay Fine and Halfway Rock, ten to twenty fathoms; and off Spanish Head, fifteen fathoms.

Morchellium argus, off Bay Fine and Halfway Rock; and off Spanish Head, ten to twenty fathoms.

Morchellioides alderi, n.sp., shore pools, Port Erin.

Amaroucium proliferum, off Port Erin; shore, Bay-ny-Carrickey, etc.

Amaroucium sp., Port St. Mary, five fathoms.

Distoma rubrum, shore, Bay-ny-Carrickey, Port Erin, etc.

Distoma vitrea, shore, Port Erin.

Distoma sp., Port Erin, twenty fathoms.

Botryllus violaceus, shore, Bay-ny-Carrickey, Port Erin, etc.

Botryllus morio, shore pool, Port Erin.

Botryllus smaragdus, Port Erin.

Botryllus schlosseri, shore, Port Erin, Bay-ny-Carrickey, etc.

Botryllus pruinosus, shore, Port Erin and Bay-ny-Carrickey.

Polycyclus savignii, off Halfway Rock and Bradda Head, Port Erin.

Botrylloides albicans, shore, Port Erin, Bay-ny-Carrickey.

Botrylloides sp., Port Erin.

Botrylloides rubrum, off Spanish Head, ten to twenty fathoms, common; also shore, Port Erin, etc.

Botrylloides leachii, Port Erin.

Leptoclinum maculosum, shore, Bay-ny-Carrickey, Port Erin, Spanish Head, etc.

Leptoclinum asperum, off Port Erin, and at Bay-ny-Carrickey.

Leptoclinum durum, off breakwater, Port Erin, ten fathoms.

Leptoclinum candidum, Port St. Mary, five fathoms, etc.

Diplosoma gelatinosum, on Zoophytes, etc., Port Erin and Bay-ny-Carrickey.

Diplosoma crystallinum, Port St. Mary, five fathoms; shore, Port Erin.

NOTES on some of the POLYCHÆTA collected by the L. M. B. C.

By R. J. Harvey Gibson, M.A., F.R.S.E., F.R.M.S.,
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This paper deals with—

(1.) The value of the setæ of the Polychæta as specific characters.

(2.) The structure of the following Aphroditidæ :—

(*a.*) *Malmgrenia castanea*, McIntosh.

(*b.*) *Hermadion assimile*, McIntosh.

(3.) On *Pectinaria auricoma*, Müller, and *Pectinaria belgica*, Pallas.

1. With reference to the first of the above subjects, a few remarks may appropriately be made here.

McIntosh* lays great stress on the importance of the setæ as specific characters, and insists on the accurate delineation of typical examples. In speaking of the setæ, he says :—

"It is impossible, for example, to describe too minutely in groups like the Polynoidæ, in which the specific separation rests on so many fine characters The mere statement that a bristle is slender and serrated conveys little more to the mind than the assertion, in comparing the hair of a bat with that of a sheep, that each is serrated. Even some of the most distinguished investigators of the Annelida have failed to appreciate the valuable results derived from a strict and faithful apprehension of the structure of the bristles, the other characters, of course, being duly attended to. The characteristic markings at the tips of the bristles of *Hermadion pellucidum* and *H. assimile*, for instance, shew how valuable such characters will some day be in

* On British Annelida, *Trans. Zool. Soc.*, Lond., ix, 371.

classification. . . The distinctions between many of the species are nice, yet exact, and afford a good field for scientific accuracy in microscopic work."

Bourne* mentions the neuropodial and notopodial setæ as variable in the series of *Polynoë clava* examined by him, but remarks that the characters of *equivalent* setæ were constant.

After a careful examination of the Polynoidæ of the L. M. B. C. collection,† I can scarcely think that the setæ are such trustworthy guides in the identification of species as Prof. McIntosh believes them to be. In the first place, in the individual the setæ vary much, as Bourne observes, not only in colour, but in size, in curve, markings, and serrations. I mounted the entire series of parapodia from three examples of *Harmothoë imbricata*, and was astonished to find that the amount of variation was very considerable. I was fortunately able to mount entire two or three young specimens of *H. imbricata*, and there also the differences between the bristles of the young and those of the adult were observable. I did the same for *Polynoë clava*, with similar result. No doubt, in aberrant Polynoidæ like *Hermadion assimile* (Pl. VIII), the spines are reliable guides, but no one would require to look at the spines to identify such a form.

I agree with Bourne, that comparison of *equivalent* setæ is useful, but with all due deference to so high an authority as Dr. McIntosh, I would feel doubtful of resting the identification of species so much on the character of the setæ as he seems to be inclined to do.‡ I would equally doubt the advisability of trusting too much to the form of the parapodia themselves as is done by Dr. Hj. Théel, in his

* *Trans. Linn. Soc. Lond., Zool.*, 2nd ser., vol. ii, p. 349.

† See Report on the Vermes, p. 144.

‡ Compare "Challenger" Report on Annelides, by Professor McIntosh, F.R.S. Dr. McIntosh does not state, in many cases, from what segment of the body the bristles are taken.

*Annélides Polychètes des Mers de la Nouvelle-Zemble.** As is pointed out by Bourne (*loc. cit.*), the shape of the parapodia is variable in one and the same individual, and equivalent parapodia must in all cases be compared. At the same time, even then the normal shape of the parapodia may be altered by the presence of eggs in the body cavity, the amount of retraction of the acicula, and the condition of the cæca of the alimentary canal. The general appearance, the number of segments, and a typical transverse section require to be more attended to than they are; the merest outline of the form, natural size, with any striking character, seems an accompaniment to a description of new or rare species very much needed.

Since writing the above, I have been glad to find my opinion supported by Hansen, in his Report on the Annelides of the Norwegian North Atlantic Expedition.† I quote the sentences more especially bearing on the point in question. After pointing out that Malmgren has attached especial weight to the distinctive features of the pedal bristles, considering them, indeed, as of generic value, he goes on to say:—

"From what is stated here, a considerable difference might be inferred to exist between the members of the family *Polynoidæ*, and not only as concerns the structure of the bristles, but also with regard to the external anatomical features of the animals. This, however, is not the case, as will at once appear from a glance at Malmgren's own drawings. Indeed, unless carefully examined in detail, it is hardly possible to distinguish between them, so closely do the animals resemble one another. . . . The last feature to adduce as a generic character would be, if justly considered, the structure of the bristles, which are so remarkably alike in well-nigh all *Polynoæ* that very considerable difficulty is frequently experienced in distinguishing between

* *Kongl. Svenska. Vetenskaps-Akademiens Handlingar*, Bandet xvi, No. 3, 1879.

† Den Norske Nordhavs-Expedition, 1876–78, *Zoologi*, *Annelida*, ved G. Armauer Hansen, 1882.

them; and as for types of bristles, there is nothing of the kind, characters founded on such an assumption being altogether spurious. The fact of the dorsal bristles being shorter or thicker than the ventral, or *vice versa*, and that of the ventral bristles being cleft or not cleft at the points, cannot be regarded as typical peculiarities of structure, generic or specific. . . . And this, as I conceive, peculiar unfitness of the bristles to furnish a sure and obvious basis on which might be established a natural division of the Polynoidæ into numerous genera, extends, I think, with equal force to specific diagnoses."

2. Among the Aphroditidæ dredged by the L. M. B. C., are the rare forms, *Malmgrenia castanea*, McI., and *Hermadion assimile*, McI. These seem to merit fuller notice than they have obtained in the general report.*

(*a.*) *Malmgrenia castanea*, McIntosh, *Trans. Zool. Soc.*, vol. ix, p. 376.

Localities (by Gwyn Jeffreys).—N. Uist, 90–96 fathoms, 1867, and in 1868.

On *Spatangus purpureus* (near mouth), eighty-five fathoms. Off Valentia, in eighty fathoms, and off Blasquet, in a hundred and ten fathoms, off the Channel Islands.

Six miles north of Great Ormes Head, fourteen fathoms, in ambulacral groove of *Astropecten irregularis* (L. M. B. C.).

The head was not present on the specimens obtained by the L. M. B. C., but according to McIntosh, "the head is slightly pinkish in life, as is also the proboscidian region, two eyes are situated near the posterior border, and two laterally on the anterior prominence. The tentacle is moderately developed, and has a slight enlargement below the tapering tip. The antennæ have brownish pigment a little above the base."

The body is very long, there being about eighty to a hundred segments. McIntosh states that there are fifteen pairs of scales. The scales, which are "reniform" or

* See Report on Vermes, p. 144.

quadrate, and have a dark belt along their anterior margin, are attached to the dorsal surface of the body on every fourth segment (see Pl. VII, fig. 6). Every elytron-bearing segment possesses two protuberances, rounded or quadrate on surface (Pl. VII, fig. 6, *d*), and each forming a low column, about $\frac{1}{16}$ in. high. The surface of the protuberance is attached to a depression in the under surface of the scale to the left (or right, for the right-hand scales of the middle line). The segments which bear the elytra have no dorsal cirri. The non-elytron-bearing segments have cirri (Pl. VII, fig. 6, *a*), but they have also protuberances identical in position, but not in form, with the elytron-bearing protuberances. Both segments intervening between two elytron-bearing segments have similar protuberances (Pl. VII, fig. 6, *b*, *c*). Each of these is a short column, oval in section, having its long axis at right angles to the long axis of the body, and having its internal and external angles produced into horns. These horns on their ventral sufaces, and a considerable portion of the columns, are covered by ciliated epithelium (see Pl. VII, fig. 3), which probably fulfils a branchial function. The scales are arranged so that the left-hand scale overlies the right-hand one. Their posterior margins are inserted between the two branchial protuberances, overlying the anterior and underlying the posterior of these. The dorsal cirri, as stated by McIntosh, are perfectly smooth (Pl. VII, fig. 6, *a*). The bristles are described and figured by McIntosh (*loc. cit.*).

In transverse section the attachment of muscles to the elytron-bearing protuberance is seen (Pl. VII, fig. 1). Two pseudhæmal vessels appear one above the alimentary canal, between the two masses of the dorsal muscles, the other beneath the alimentary canal, and lying in connection with the reproductive follicles and immediately above it. The vessels are not lined by epithelium, and are probably simply portions of the cœlome cut off. The outer wall of the

ventral vessel is covered by large epithelial cells, which on its under aspect become aggregated into a plate with lateral ridges, forming the genital gland (Pl. VII, fig. 2). From these ridges the ova (or spermatozoa) are budded off into the cœlome.* The alimentary canal shews very well the relationship of the intestinal cæca to the intestine itself. Prolongations of these cæca are carried up into the dorsal protuberances (Pl. VII, figs. 1 and 5). Like Bourne, I have not discovered any communication between the scale cavity and the body cavity; the epithelium covering the surface of the knob is entire, even over the attachment of the muscle. Moreover, the epithelial cells bearing the cilia on the "branchiæ" are quite as large as anywhere else, and there are bands of muscle and connective tissue between the superficial epithelium and the wall of the cæcum. The intestine is lined by columnar ciliated epithelium in one or more layers. The epithelial layer is frequently folded, but the folds do not affect the muscular wall. The folds are epithelial only; the muscular wall is extremely thin, consisting of a very few fibres, arranged, the inner layer circularly, the outer longitudinal. The cæca open into the alimentary canal by funnel-shaped openings. The funnel is lined by columnar ciliated epithelium, the cilia being very long and pointing towards the cavity of the intestine (Pl. VII, fig. 5). The cæca are branched and send prolongations into the dorsal protuberances, as above stated. The funnel has a layer of circular muscle, slightly thicker than that forming the body wall of the intestine. The cells lining the cæca are glandular and secretory (Pl. VII, fig. 5), and frequently shew clear superficial portions which often contain concretions. I can scarcely agree with Haswell in considering that intestinal respiration goes on to any great extent, at

* See Haswell, "Monograph on the Australian Aphroditida," *Proc. Linn. Soc., N.S.W.*, vol. vii.

least in this form, and in those where, owing to the power of movement of the scales, the muscle layer is well developed. Further, the ova frequently become pushed up to form a distinct layer between the muscle and the wall of the cæcum, so that a considerable thickness of tissue intervenes between the superficial epithelium and the intestinal wall.

Finally, the acicular muscles fill up the cœlome beneath the cæca and intestine (Pl. VII, fig. 1). The muscles are large, and are attached to the inner end of the aciculum only in a radiating manner. The aciculum has a knob-shaped end, which forms a basis for attachment of the muscles. The acicula are, moreover, connected to each other by muscle bands at their bases (Pl. VII, fig. 4).

(*b.*) *Hermadion assimile*, McIntosh, *Trans. Zool. Soc*, ix, 387.

Localities.—St. Andrews; west coast of Ireland; south of England; off the Spanish coast, in the "Porcupine" expedition; and, by the L. M. B. C., at Bay Fine, near Port Erin, Isle of Man, in ten fathoms, from a gravelly bottom.

One or two points in the anatomy of this species seem worthy of note.

The alimentary canal does not present the usual branched lateral cæca which are so characteristic of the Aphroditidæ. On the contrary, it presents merely a series of alternate constictions and bulgings, the swellings corresponding to the segmental space. The entire canal is lined by granular columnar non-ciliated cells, corresponding to those found in the cæca of the ordinary type. The parapodia are very large and elongated. McIntosh figures the spines (*loc. cit.*) which are tolerably numerous and more uniform throughout the series of parapodia than one usually finds them. McIntosh mentions the presence of a median tentacle on the head; that was, however, absent in the specimen obtained off the

Manx coast; a very clearly-defined scar was, however, present, indicating probably the position of the lost tentacle (see Pl. VIII, fig. 1). The proboscis was long, and presented in section a quadrate lumen, owing to the arrangement of the layers of muscle.

Along the ventral surface of the anterior part of the body, more especially upon the ridges formed by the longitudinal muscle bands, a large number of minute globular projections were seen (Pl. VIII, fig. 2). Each projection was ovoid or elliptical in vertical section. Each has a central core, covered by a thick cuticle, which is continuous with the cuticle over the ventral surface of the body. The cuticle over the papilla is faintly striated at right angles to the surface (Pl. VIII, fig. 4). The core is granular and fibrillar, and towards the base shews larger nuclear looking bodies. The core is directly continuous with fibrillæ from nerve fibres, which are abundantly distributed to the ventral surface of the body. The stalk of the papilla is very thin and hyaline in appearance, and contains a central core, composed of fibrillæ, connecting the nerve fibres with the core of the papilla (Pl. VIII, fig. 3). The nervous system is very much flattened dorso ventrally, and gives off very large nerves to the sides of the body, fibres from which supply the abovementioned papillæ, which are doubtless some form of tactile sense organ not previously noticed.

The specimen examined was a female, and every available space in the cœlome was filled with eggs, which took on carmine staining very deeply.

(*c.*) On the synonymy of *Pectinaria belgica*, Pallas, and *Pectinaria auricoma*, Müller.

Pectinaria belgica was described under the synonym of *Nereis cylindraria*, var. *belgica* by Pallas, in his "Miscellanea Zoologica," 1766; and *Pectinaria auricoma* was

described under the synonym of *Amphitrite auricoma* by O. F. Müller, in his "Zoologica Danica," in 1788. Pennant, in his "British Zoology," describes *Amphitrite auricoma*, and mentions, as a synonym, *Nereis cylindraria* of Pallas, that is to say, the variety *belgica* above mentioned. Dalyell, in his "Powers of the Creator," describes *Amphitrite auricoma*, but calls it *Sabella belgica*. Claus, in his "Traité de Zoologie," acknowledges both *P. auricoma* of Müller, and *P. belgica* of Pallas. Gosse acknowledges *P. belgica* only ("Marine Biology"). Similarly, *P. auricoma* is omitted from the List of British Marine Invertebrata, drawn up by a Committee of the British Association, in 1861, and from Forbes's paper in Brit. Assoc. Report, 1850. McIntosh (Ency. Brit., art. "Annelides") figures *P. belgica* of Pallas, after Malmgren. Finally, Möbius ("Zoologische Ergebnisse") acknowledges both *P. auricoma* of Müller and *P. belgica* of Pallas. Apparently, two distinct species are first of all figured and described by Pallas and Müller respectively, Pallas having the precedence in time; Pennant, Dalyell, and others mix up the two species together; more recent authorities omit either one or other, consider them as one species, or acknowledge them to be distinct. It seems worth while to compare Pallas's and Müller's accounts, in order to determine whether there are points of distinction between them of sufficient importance to justify their being separated from each other.

Müller (*loc. cit.*) gives as the specific characters of his *Amphitrite auricoma* the presence of two cirri on either side of the head, and two rigid yellow fans in front. On examining Pallas's drawings of *P. belgica*, his *Nereis cylindraria*, var. *belgica* (*loc. cit.*), the pair of cirri are found to be present on either side of the head, just as Müller describes them in *P. auricoma;* but his figure of the stiff golden comb shews one continuous and uniform series of teeth, not two

series, as in *P. auricoma*. At the same time, Pallas does not distinctly state the condition of the comb in the form he describes. He compares it, however, with *Nereis cylindraria* var. *capensis*, and says: "Maxime insignes in eo (capite) sunt palmulæ binæ (figs. 1, 2; 7, 8, 9, *a*) rotundatæ, factæ ex paleolis seu aciculis planis, auratis, linearis-acutis, interioribus in qualibet palmula sensim minoribus et angustioribus, exterioribus pariter decrescentibus, at latioribus; omnibus versus dorsum leviter recurvatis. Hæ paleolæ itæ carnoso capiti implantatæ sunt, ut imbricatim (instar remigum in ala avis) exteriores interioribus superadcubent." All these characters are equally true of the combs of *P. auricoma*. Further, Pallas refers to a plate on which both var. *capensis* and var. *belgica* are figured; figs. 1 and 2 are of the former, and there the double comb is quite distinguishable, although not very accurately drawn; figs. 7, 8 and 9, however, which are referred to at the same place (see quotation), are of var. *belgica*, and do not shew the binary condition at all, with the exception of fig. 9, which does shew the teeth divided into two series. Dalyell figures (*loc. cit.*) a form which he calls "*Sabella belgica* or *Amphitrite auricoma*," and in his drawing two combs (whose existence he mentions in the text) are visible.

McIntosh's figure (*loc. cit.*) of *P. belgica* shews the two combs with perfect accuracy and distinctness. Either Pallas's draughtsman * has made an error in most of the figures of *P. belgica*, and failed to represent the comb with sufficient accuracy, hence leading Müller into error when comparing his form with that of Pallas, or Pallas's figures are correct (although his references in the text are wrong), and his species is distinct from that of Müller (for the condition of the comb appears to be the only important difference between the two). Looking at the inaccuracy of the drawings as com-

* It is to be noted that Pallas did not draw his own plate.

pared with var. *capensis* in Pallas's work, and taking into account the indistinctly double series of teeth shewn in figs. 5, 8 and 9 of var. *belgica*, I think that probably the former view is the most likely to be the correct one. In that case *P. auricoma* of Müller disappears, and becomes *P. belgica* of Pallas.

Dalyell, then, is right in considering them as one form, and Malmgren is right in figuring as *P. belgica* a form with a comb in all respects identical with that described by Müller as peculiar to *P. auricoma*. Other writers have probably not compared the original authorities, and so have simply taken for granted the existence of two distinct species. I have reproduced in Plate VIII (figs. 5–7) the original figures of Müller and Pallas in order that they might be compared with that of Malmgren (fig. 8).

Explanation of the Plates.

Plate VII.

Malmgrenia castanea, McIntosh.

Fig. 1. Transverse section of the body, magnified 50 diameters.

Fig. 2. Transverse section of the sub-intestinal pseudhaemal vessel, magnified 300 diameters.

Fig. 3. Transverse section of the elytron-bearing protuberance, magnified 300 diameters.

Fig. 4. The bases of the acicula, shewing the mode of attachment of the muscles, magnified 300 diameters.

Fig. 5. Transverse section of the alimentary canal and its cæca, magnified 300 diameters.

Fig. 6. The dorsal surface of four segments from the middle of the body, magnified 50 diameters.

Plate VIII.

Figs. 1–4. *Hermadion assimile*, McIntosh.

Figs. 5–9. *Pectinaria belgica*, Pallas.

Fig. 1. Head and part of the everted pharynx of *H. assimile*, × 10 diameters.

Fig. 2. Vertical section of ventral surface of *H. assimile*, × 50 diameters. *b*. Nervous system.

Figs. 3 and 4. Ventral papillæ of *H. assimile*, × 300 diameters.

Figs. 5 and 6. *P. belgica*, after Pallas enlarged; *a*. Comb.

Fig. 7. *P. belgica*, after Müller (his *P. auricoma*); enlarged.

Fig. 8. *P. belgica*, after Malmgren; enlarged.

Fig. 9. *P. belgica*, from a specimen in the L. M. B. C. collection; enlarged.

NOTES on VARIATION in the TUNICATA.

By W. A. Herdman, D.Sc., F.L.S.,

PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, LIVERPOOL.

It is often a matter of very great difficulty to fix upon good diagnostic characters in the Tunicata, and to distinguish between allied species, and varieties, and mere individual variations. I propose to discuss in this paper the most reliable characters for making use of in describing the species, and to give examples of some of the variations to which these and other parts of the body of an Ascidian are liable.

In the first place, it is quite absurd to attempt to describe, or even, in most cases, to identify, an Ascidian, without dissection and microscopic examination. As Savigny long ago said,* "Les Ascidies ont l'organisation variée et l'aspect uniforme. La configuration qui leur est affectée ne permet pas que les différences intérieures se manifestent au-dehors par des signes fort sensibles. Aussi les distinctions nécessaires à la parfaite connaissance des espèces sont-elle difficiles à tracer."

In some cases the genus, and even sometimes the family, cannot be determined without dissection. For example, in many museums and other collections, all Simple Ascidians which are incrusted with sand and shell fragments are labelled "*Molgula*," but some of these specimens usually belong to the genus *Eugyra* (to distinguish which the branchial sac ought to be examined), and in

* *Mémoires*, p. 84. 1816.

some cases they belong to *Polycarpa*, a member of the family Cynthiidæ, and they may even be Ascidiidæ (*e. g.*, *Ascidia involuta*, Heller). It is even possible that such forms might be Compound Ascidians, as *Polyclinum sabulosum* and various species of *Psammaplidium* are incrusted with sand, and, in external appearance, mimic the Molgulidæ.

This instance is sufficient to shew how rash it is to attempt to identify a series of Ascidians without a thorough anatomical examination; and it is of the greatest importance that new species should be sufficiently described, not only in their external appearance, but in their internal structure. Most of the older descriptions of Ascidians are, on this account, of little or no value. With a very few exceptions, they consist merely of more or less minute accounts of the external appearance of the animal, and frequently give no clue to even the genus to which the species belonged. Consequently, many of the British Ascidians, both Simple and Compound, require to be carefully re-examined and fully described before they can be referred to their proper genera, and before they can be compared with the species described from other European seas by such careful investigators as Traustedt, Lacaze-Duthiers, von Drasche, and others.

One of the first matters to be determined is, which anatomical characters are of most importance in distinguishing allied species; and, with the view of settling this important point, I have taken advantage of every opportunity afforded me during the last six years, of examining the structural details of large numbers of the commoner British species. While conducting this investigation, I have been greatly struck by the large amount of individual variation present within the limits of a species, even in the case of important organs such as the branchial sac and the tentacles. I have already discussed such individual variations in the case of

some few species in former papers,* but the specimens collected during last summer in Liverpool Bay, taken along with those formerly dredged on various parts of the west coast, have supplied me with additional examples, some of which seem worthy of being recorded. The general conclusion at which I have arrived is that not one of the characters usually employed in the description of species of Ascidians is constant. They are all liable to more or less variation, and, in the case of some of them, the range of variation is very great. I regard the following as the characters which should be attended to in describing a Simple Ascidian :—

1. The External Appearance. This is liable to considerable variation according to the surroundings. The more important points to mention are—the general shape, the position and extent of the area of attachment, the position and condition of the branchial and atrial apertures, their lobes, the condition of the surface (rough, smooth, etc.), the colour, the length (antero-posterior), the breadth (dorso-ventral), and the thickness (lateral).

2. The Test. Its consistence (leathery, gelatinous, cartilaginous, etc.), thickness, strength, transparency, colour (on surface and in section), and minute structure. Under the last head may be mentioned the presence and condition of vessels, test-cells, bladder-cells, pigment-cells, etc.

3. The Mantle. Its relative thickness, its transparency and colour, the condition of its musculature, the condition of the branchial and atrial siphons, and any peculiarities of the body as seen on removal of the test.

4. The Branchial Sac. Its relative size, its shape, relative thickness of its walls; the presence of folds, their number, size, and direction; the arrangement of the internal longitudinal bars in relation to the folds, the presence or

* See especially *Journ. Linn. Soc. Lond., Zool.*, vol. xv, p. 329, and *Proc. R. Phys. Soc. Edin.*, vol. vi, p. 256. 1881.

absence of minute plication in the wall, the papillæ on the internal longitudinal bars, the condition of the transverse vessels, the shape of the meshes; the shape, size, and arrangement of the stigmata.

5. The Dorsal Lamina. Its condition, a membrane or languets; if a membrane, its relative size, and the presence and condition of transverse ribs and marginal teeth or processes; if languets, their size and shape.

6. The Tentacles. Simple or compound; their number, size, and arrangement.

7. The Dorsal Tubercle. Its relative size, its position, the peri-tubercular area, the shape of the tubercle, the position of its aperture, and the curving of its horns—if present.

8. To these characters may be added any noteworthy points in regard to the alimentary canal and the reproductive organs.

In describing a Compound Ascidian, besides attending to the above-mentioned characters, or most of them, it is necessary to examine the shape of the body of the Ascidiozooid, the arrangement of the Ascidiozooids in systems (or cœnobii), and the arrangement of the systems in the colony (or cormus).

The test is always liable to be affected by surroundings such as the object to which the Ascidian is attached, still it very frequently affords good specific characters.

The number of lobes surrounding the branchial and atrial apertures is perhaps the most constant of all the external characters, and yet even it is liable to a certain amount of variation; for example, it is the rule for the genus *Ascidia* to have eight branchial lobes and six atrial, but in some species (*e. g.*, *Ascidia mentula*) the number of branchial lobes may be seven or nine, and the number of atrial lobes five. I have seen a specimen of *Ciona intesti-*

nalis with only six lobes, in place of eight, round the branchial aperture.

The mantle very rarely gives definite characters which can be made use of in specification, but, in some cases, its proportions and the general appearance of its musculature afford indications to those who are familiar with the species. The mantle is also of importance in distinguishing some genera (*e. g.*, *Ciona* and *Molgula*).

Probably the most important organ is the branchial sac. It gives characters which serve to distinguish families, genera, and species. Its larger features, such as the presence or absence of folds, and the arrangement of the internal longitudinal bars, are of great importance in classifying the Simple and Compound Ascidians, and these characters are constant.

Other less conspicuous features, such as those derived from the transverse vessels, the meshes, and the stigmata, are useful in distinguishing species, and should always be described, but they are liable to a great deal of variation, especially towards the dorsal and ventral edges of the sac. (Figure 8 on Plate IX. shews an example of this in the case of *Ascidia plebeia*.) Consequently, the part of the wall selected for examination should be taken from about the middle of one side of the branchial sac.

It is not uncommon in the Ascidiidæ to find that, towards the edges of the sac, the internal longitudinal bars become broken up and imperfect, so as to be reduced to irregular split papillæ, attached to the transverse vessels at the corners of the meshes (Pl. IX, fig. 8). I figured this condition in 1880,* in the case of an *Ascidia*, and in 1882,† in *Corella japonica*; since then I have met with it in a number of other species of Simple Ascidians, and

* *Journ. Linn. Soc., Zool.*, vol. xv, pl. xvi, fig. 6.

† "Challenger" Expedition Report, Zool., No. xvii, pl. xxvi, fig. 8.

one of the new Compound Ascidians, obtained during the "Challenger" expedition, *Tylobranchion speciosum*, from Kerguelen Island, has a number of branched papillæ on the transverse vessels of the branchial sac, which are, I believe, simply connecting ducts with rudimentary internal longitudinal bars attached to them. Similarly, I am inclined to regard the small papillæ which project from the transverse vessels in *Perophora listeri* as being really connecting ducts upon the ends of which internal longitudinal bars might possibly have been developed. Figures 1 to 4 on Plate IX. shew a series of stages by which a complete internal longitudinal bar (fig. 1, *i. l*) might be reduced to simple papillæ, projecting from the transverse vessels at the angles of a mesh (fig. 4, *c. d*). All these stages may be seen as irregularities or variations in the branchial sacs of some British Ascidians.

In describing the shape of the meshes and the number of stigmata they contain, it is necessary to avoid the edges of the sac, since the dorsal and ventral rows of meshes are usually very much larger than the rest, and sometimes contain twice as many stigmata. In some branchial sacs the stigmata are, as individual varieties, exceedingly irregular in their arrangement, and this appears to be especially the case where there are several orders of transverse vessels present (*e. g.*, large, small, and medium-sized vessels, arranged alternately), some stigmata being twice or even thrice as long as their neighbours (see Pl. IX, fig. 5).

The small transverse vessels (or horizontal membranes) are very inconstant, and cannot be depended upon. In those species where they occur, they may be present in one mesh, dividing it horizontally into two parts, and absent in all the neighbouring meshes, or they may be present in nearly every mesh of the sac (Pl. IX. figs. 5 and 6, *tr''*). In some cases, they interrupt the stigmata, while in others the stigmata pass

continuously behind the horizontal membranes from one transverse vessel to the next. Roule, in his important work on the Simple Ascidians of the coasts of Provence,* seems to consider that these horizontal membranes, or transverse vessels of the third order, are characteristic of *Ciona intestinalis*, and also that they are always present in the branchial sac of that species. The fact is that (1) the horizontal membranes are present in many other species of Simple Ascidians, and (2) that they are liable to variation in *Ciona intestinalis* just as they are in other cases. I figure here (Pl. IX. fig. 6) a part of the branchial sac of a specimen of *Ciona intestinalis* from the Isle of Man, which shews the delicate vessels in question present in some meshes and absent in others.

The endostyle is not of much value as a diagnostic feature. Its characters are very much the same in all allied species.

The dorsal lamina is of importance. In the different species of the Ascidiidæ it presents all intermediate conditions between a plain broad membrane (the true dorsal lamina) with a straight margin, and a series of long tentacle-like languets. *Ascidia plebeia* is particularly instructive in connection with these intermediate stages. This species has a true dorsal lamina, but the membrane is crossed by transverse ribs or ridges, and, at the margin, these are continued into projecting teeth or processes. In some specimens the

* *Annales du Musée de Marseille, Zoologie*, tome ii, Memoire No. 1, 1884. I take this opportunity of correcting an erroneous statement made by M. Roule in a footnote on page 212 of his work. In referring to woodcut fig. 9 of the first part of my Report upon the "Challenger" Tunicata, he says that I have erroneously represented the viscera of *Ascidia* on the right side of the body in place of on the left. That is not the case. My figure represents a transverse section of the body, viewed from its anterior surface. The top is dorsal. The animal's right side is on the observer's left, and the viscera are placed on the left side of the branchial sac, as they ought to be.

marginal teeth are slight, but in others they are long tentacle-like projections comparable with languets.*

The tentacles at the base of the branchial siphon are of considerable value in characterizing species, genera, and families. In most Ascidians they are simple elongated processes, but in the Molgulidæ, and in two sub-families of the Cynthiidæ, they are compound and branched. In many species the tentacles are of two or more sizes, and the different orders are arranged with regularity. The smaller and more numerous tentacles are always the most liable to variations, such as suppression, reduplication, and irregularity in position. Sometimes, in place of all the tentacles springing from the same line, one order is inserted further forward or further back than the others. This is sometimes the case in *Ascidia plebeia*, † and I have recently found the same condition in a Compound Ascidian ‡ (*Botryllus smaragdus*).

The dorsal tubercle, which is the more or less complicated aperture of the duct from the subneural gland, is a very variable organ, and must be used with great caution in characterizing species. I have already discussed elsewhere § the range of variation of the dorsal tubercle in some of the commoner species of British Ascidians, and, in examining the collection of Tunicata from Liverpool Bay, I have met with some marked cases of variation in this organ. In a specimen of *Polycarpa pomaria*, a species in which the dorsal tubercle is usually cordate in outline, it was found to be a complete ring—a condition sometimes seen as a variation in *Styela grossularia*. In a specimen of *Molgula occulta*, again, one of

* See Pl. VI. fig. 5, *l*, illustrating the Report upon the Tunicata of the L. M. B. C. district, in this volume.

† See *Journ. Linn. Soc., Zool.*, vol. xv, pl. xix, fig. 4.

‡ See Pl. VI., fig. 7, illustrating the Report upon the Tunicata of the L. M. B. C. district, in this volume.

§ Especially in *Proc. R. Phys. Soc. Edin.*, vol. vi, p. 256. 1881.

the horns of the dorsal tubercle was found to bifurcate, a condition which has apparently not been previously noticed.

Some Ascidians vary greatly in the amount, the position, and the colours of their pigmentation. *Ascidia scabra* and *Ascidia virginea* may be mentioned as being particularly variable in this respect. I have recently examined a large number of specimens of *Ciona intestinalis*, in the living condition, from the Isle of Man and other parts of the west coast, with the view of determining what amount of variation exists in regard to the two conspicuous red pigment spots placed in that species near the anterior end of the body, one on the dorsal and the other on the ventral edge (see Pl. IX. fig. 7) of the branchial sac.

The dorsal pigment spot (Pl. IX. fig. 7, and fig. 9, *d. p.*) is a rounded mass placed on the outer (*i.e.* dorsal and anterior) surface of the nerve ganglion; it must not be confused with the pigmented glandular mass of the same colour placed a little further back, upon the anterior extremity of the vas deferens, and which is regarded by Roule* as a renal organ. The ventral pigment spot (Pl. IX. fig. 7, and fig. 10, *v. p.*) is a mass of crescentic form which curves round the anterior extremity of the endostyle, in front of the peripharyngeal bands (Pl. IX. fig. 10, *v. p.*).

After noticing these red spots in many specimens of *Ciona intestinalis*, it was natural to conclude that they are always present in the species, and consequently, I was rather astonished to find that amongst half a dozen specimens, living in a small aquarium, two had no pigment spots at the anterior end of the body. I then examined, in the fully expanded condition, every specimen of *Ciona intestinalis* which I dredged until one hundred and fifty had been collected. This series shewed that the four possible variations in regard to the pigment spots—viz., with both spots present,

* *Recherches sur les Ascidies Simples des Côtes de Provence*, p. 170. 1884.

with both absent, with only the dorsal spot, and with only the ventral spot—were all found. The specimens examined were all of moderate size, and, consequently, immaturity could not account for the absence of the pigment in any of the cases.

The following table shews the number of individuals with each particular variation in the first twenty, the next eighty, and the last fifty specimens examined:—

Number of specimens examined.	With both pigment spots present.	With only the dorsal spot present.	With only the ventral spot present.	With neither of the spots present.
20	10	3	2	5
80	28	6	14	32
50	26	3	7	14
150	64	12	23	51

So far as these numbers go, they shew that about two-thirds of the individuals of *Ciona intestinalis* have the anterior end of the body pigmented, and more than half of those (about one-third of the whole) have both the pigment spots present. Of the four conditions found, that with both spots and that with neither are the most frequently met with, while specimens with the dorsal pigment spot alone are rarer than those with a ventral spot only. These spots are merely aggregations of round pigmented connective-tissue cells in the mantle. Their function, if they have any definite function, is still unknown.

Explanation of Plate IX.

Figs. 1–4. Variations in the internal longitudinal bars and connecting ducts of Simple Ascidians.

Figs. 5 and 6. Variations in the branchial sac of *Ciona intestinalis*, × 50 diameters.

Fig. 7. Anterior end of *Ciona intestinalis*, showing pigment spots, enlarged.

Fig. 8. Imperfect internal longitudinal bars of *Ascidia plebeia*, × 50 diameters.

Fig. 9. Dorsal pigment spot, &c., of *Ciona intestinalis*, × 300 diameters.

Fig. 10. Ventral pigment spot, &c., of *Ciona intestinalis*, × 300 diameters.

at, atrial aperture; *br*, branchial aperture; *c.d*, connecting duct; *d.p*, dorsal pigment spot; *d.t*, dorsal tubercle; *en*, endostyle; *h.m*, horizontal membrane; *i.l*, internal longitudinal bar; *l.v*, fine longitudinal vessel; *n.g*, nerve ganglion; *n*, nerves; *p.p'*, large and small papillæ; *p.p*, peripharyngeal band; *sg*, stigmata; *tr*, *tr'*, *tr''*, transverse vessels; *v.p*, ventral pigment spot.

On a NEW SPECIES of SYCANDRA.

By R. J. Harvey Gibson, M.A., F.R.S.E. F.R.M.S.,
demonstrator of zoology in university college, liverpool.

In the collection of worms dredged off the south end of the Isle of Man, a specimen was found which, at first sight, seemed to be extremely like the rare and interesting genus *Chætoderma*, and as such was labelled and put aside for further examination. When, however, it was sectionized and examined in detail, it was soon found to be a calcareous sponge.

In shape it is fusiform, the narrower end being provided with a slight rim or fold (Pl. X, fig. 1). Its length is 8 mm.; its breadth, at the narrow end, 1 mm.; at its thickest part, 3½ mm.; and at the terminal opening 1½ mm. The entire surface of the body is studded with blunt-headed calcareous spicules, which had at first suggested the possibility of its being a *Chætoderma*.

In transverse section (Pl. X, fig. 2) the usual poriferal characteristics appear, namely, a central cavity communicating with the exterior by a series of closely placed ciliated canals or chambers. The chambers are ovoid in horizontal section, communicating with the interior and exterior by slightly-constricted openings. These were well seen on the sloughing of the superficial layer of tissue and spicules, which took place when the animal was put in gum, as a preliminary to freezing and sectionizing. In a section taken from the centre of the thickest portion of this body, twenty-eight of these chambers are seen in horizontal section. They lie in a hyaline syncytium, containing a number of

branched granular corpuscles (Pl. X, fig. 3, 4). The chambers themselves are lined by cubical granular nucleated endoderm, each cell having the characteristic collar and cilium (see Pl. X, fig. 4). In the syncytium, externally, internally, and between the chambers, the spicules are placed. These are of four different forms. Inserted between the chambers, as a rule, are long club-shaped spicules, the pointed ends plunged into the syncytium, while the clubbed heads are free and extend for some distance beyond the surface of the body (Pl. X, fig. 3). In addition to these spicules, there are also a large number of the ordinary triradiate type, some large and T-shaped, others much smaller, and having their rays diverging at equal angles to each other (Pl. X, fig. 5). Amongst these are short needle-shaped spicules, lying irregularly in the syncytium; these might, however, be the broken ends of the club-shaped forms.

None of the species described by Hæckel* seems to agree with this form, nor have I been able to place it under any of the species described by more recent authors. The club-shaped spicules, which were generally in pairs, lying close together, seem to be characteristic, and it is probably new to science.

The specific diagnosis is as follows:—

Sycandra aspera, n. sp. (Pl. X, figs. 1–7).

Shape.—Elongated and fusiform, attached by one end.

Size.—8 mm. long, and from 1 to 3·5 mm. in breadth.

Spicules.—Four different forms—large and small triradiates, short straight spicules, and large club-shaped spicules, whose bent blunt ends extend outwards beyond the surface of the body.

Locality.—Off the south end of the Isle of Man, depth fifteen fathoms.

* *Die Kalkschwämme*, 1872.

Explanation of Plate X.

Fig. 1. *Sycandra aspera*, n.sp., × 8 diameters. *a*. Superficial layer sloughed, and shewing the openings of the ciliated chambers. The natural size is indicated at the side.

Fig. 2. Semi-diagrammatic transverse section of the body. *a*. Ciliated chamber; *b*. syncytium.

Fig. 3. Body-wall, transverse section, × 50 diameters. *a*. Club-headed spicules. *b*. Needle-shaped spicules; *c*. connective tissue cells; *d*. triradiate spicules; *e*. cavity of ciliated chamber, with epithelium wanting; *f*. do. do. with epithelium.

Fig. 4. Part of wall of a ciliated chamber, × 300 diameters. *a*. Connective tissue cells; *b*. epithelium.

Fig. 5. Triradiate spicule, large size, × 60 diameters.

Fig. 6. Club-headed spicules, × 60 diameters.

Fig. 7. Triradiate spicule, small size, × 60 diameter.

Note on the possible Naturalization of the American Clam, VENUS MERCENARIA, on the Coasts of Lancashire and Cheshire.

By Thomas J. Moore,

corr. memb. zool. soc., london,
curator of the liverpool free public museum.

Various attempts having been made to naturalize the Quahaug or American Hard-Clam, *Venus mercenaria*, in our local waters, Prof. Herdman has asked me to give a summary account of them.

In February, 1869, Capt. John H. Mortimer, commander and part owner of the ship "America," entrusted to my care a considerable supply of live Clams. A portion was sent to Mr. Frank Buckland, who, I believe, laid them down in his enclosure at Reculvers, but of which I have heard nothing more.

The remainder were divided into lots and cast into the sea at Southport, at the Great Burbo Bank, and at Crosby. At Crosby they were carefully placed by Mr. Frank Archer, assisted by Mr. R. Paden, of the Museum staff. Mr. Archer and others kept a long and careful look-out for results, but none have been forthcoming beyond the rumoured finding of a doubtful valve. This distribution is referred to in the *Proceedings of the Lit. and Phil. Soc., Liverpool*, vol. xxxiii, p. 192.

In February, 1883, Mr. F. P. Marrat printed, for distribution among his friends and correspondents, a record (a few copies of which he still has on hand) of some valves of *Venus mercenaria*, found in the previous September at Hilbre, by Mr. Geo. W. Shrubsole, of Chester, and subsequently by

Mr. J. Chard, of the Museum staff. "Over a hundred single and double valves came into Mr. Shrubsole's possession." On these Mr. Marrat remarks (and I thank him for permission to quote from his paper) that, "although none of the specimens contained the living animals, yet the condition of the shells found as above is that of fresh and not of dead specimens, the ligaments being unbroken, and the interior glassy; and many of them were so small, as not to be likely to have been worth importing for table use."

There was no evidence to induce the supposition that these specimens were descended from the 1869 distribution. On the contrary, personal testimony was given by Mr. F. T. Paul, F.R.C.S., that a recent resident, Mr. H. D. Brandreth, carrying on business in Liverpool, and living on Hilbre Island, which he rented for a time, had certainly laid down Clams (as well as American oysters) in the sea near Hilbre.

On the 28th of April, 1884, I communicated to the Literary and Philosophical Society (*Proceedings*, vol. xxxviii, p. xc), the following particulars of another distribution :—

In the month of May, 1883, a barrel of living specimens of the Quahaug or American Hard-Clam, *Venus mercenaria*, was sent to the Museum, from New York, by Captain J. H. Mortimer, Premier Associate of the Society, through the kind offices of Capt. Hamilton Perry, R.M.S.S. "Britannic," for the purpose of laying down on the neighbouring shores with a view to naturalization. A few specimens were placed in the Museum Aquaria, and, notwithstanding the extremely limited accommodation afforded by the small glass vessels in which they were placed (only twelve inches in diameter with three inches depth of sand), several are still living, and prove that the Molluscs were in healthy and favourable condition on arrival.

In reference to the planting of these Clams, Mr. F. P. Marrat kindly accompanied me, on the 19th May, to the Hoylake shore, at low water, with a view to distributing a portion there, but not thinking it sufficiently promising, we contented ourselves with casting a number into the stream beyond the bridge above the Great Float, or Birkenhead line of docks.

Subsequently I cast a larger number of Clams into the Dee, near Queen's Ferry, also at low water: and, to multiply chances, placed a few score at the disposal of Mr. Alfred O. Walker, of Chester; others I gave to Mr. Shrubsole; and both gentlemen placed them in favourable parts of the Dee.

Up to the present date, March 16th, 1886, no further captures of any kind have come to my knowledge. In the event of any such being made, both Mr. Marrat and myself will be pleased to hear of them.

The Liverpool Marine Biology Committee is indebted to the following gentlemen for assistance:—

To Mr. George Holt, Mr. J. Poole, and Mr. N. Rundell, Junr., for the use of steam-tugs for the dredging expeditions.

To Mr. R. D. Darbishire and Mr. T. J. Moore, for the use of apparatus.

To the Senate of University College, for permission to use the Zoological Laboratory for Committee meetings, etc.

SUBSCRIPTIONS RECEIVED.

I.—For general purposes:

	£	s.	d.
Mr. James Smith	5	0	0
Mr. J. J. Wood	5	0	0
Mr. A. O. Walker	2	2	0
Manchester Lit. and Phil. Soc. (Nat. Hist. Section)	5	0	0

II.—For the publication fund:

	£	s.	d.		£	s.	d.
Naturalists' Field Club	10	0	0	Wm. Unwin	1	1	0
Isaac Roberts	5	0	0	B. L. Benas	1	1	0
Dr. Carter	2	2	0	Jas. Birchall	1	1	0
Professor Herdman...	2	2	0	Josiah Marples... ...	1	1	0
Professor J. Campbell Brown	2	2	0	C. W. Jones	1	1	0
Dr. Drysdale	2	2	0	J. Linton Palmer ...	1	1	0
R. J. Harvey Gibson	2	2	0	Thos. J. Moore... ...	1	1	0
W. B. Halhed	2	2	0	Alfred Leicester ...	1	1	0
F. Archer	2	2	0	David Gamble	1	1	0
Sir J. A. Picton ...	1	1	0	John Vicars	1	1	0
Dr McClelland ...	1	1	0	R. D. Darbishire,	1	1	0
Malcolm Guthrie ...	1	1	0	Wm. Crosfield	1	0	0
Dr. Hayward	1	1	0	Isaac Byerley	1	0	0
Isaac C. Thompson...	1	1	0	Geo. Melly	1	0	0
				J. J. Fitzpatrick ...	0	10	6
				W. R. Melly	0	10	0

PLATES.

Plate I. illustrates Mr. SIDDALL'S Report on the *Foraminifera* (p. 42).

Plate II. illustrates Prof. HERDMAN'S Report on the *Alcyonaria* (p. 120), and Dr. ELLIS' Report on the *Actiniaria* (p. 123).

Plate III. illustrates Mr. LOMAS' Report on the *Polyzoa* (p. 161).

Plate IV. illustrates Mr. FOWLER'S Report on the *Amphipoda* (p. 212), and Mr. THOMPSON'S Report on the *Copepoda* (p. 201).

Plates V. and VI. illustrate Prof. HERDMAN'S Report on the *Tunicata* (p. 281).

Plates VII. and VIII. illustrate Mr. HARVEY GIBSON'S Notes on the *Polychæta* (p. 342).

Plate IX. illustrates Prof. HERDMAN'S Notes on the *Tunicata* (p. 354).

Plate X. illustrates Mr. HARVEY GIBSON'S Note on *Sycandra* (p. 365).

Plate XI. Chart of Liverpool Bay (the L. M. B. C. District).

Plate XII. Chart of the Southern end of the Isle of Man (see p. 318).

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FIG. 1.

FIG. 2

FIG. 3.

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FIG. 1. PLACOPSILINA KINGSLEYI, n. sp. x 40 dia.
FIG. 2. REOPHAX MONILIFORME, n. sp. x 50 dia.
FIG. 3. MILIOLINA SPICULIFERA, n. sp. x 100 dia.

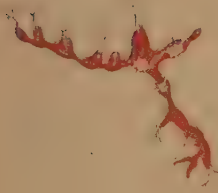


FIG 1

FIG 2.

SARCODICTYON CATENATA, Forbes.

FIG 3

FIG 4.

F.A. OWENS LITH.

D. MARPLES & C.° LITH. LIVERPOOL

CYLISTA UNDATA, var, CANDIDA, nov.

Fig 1

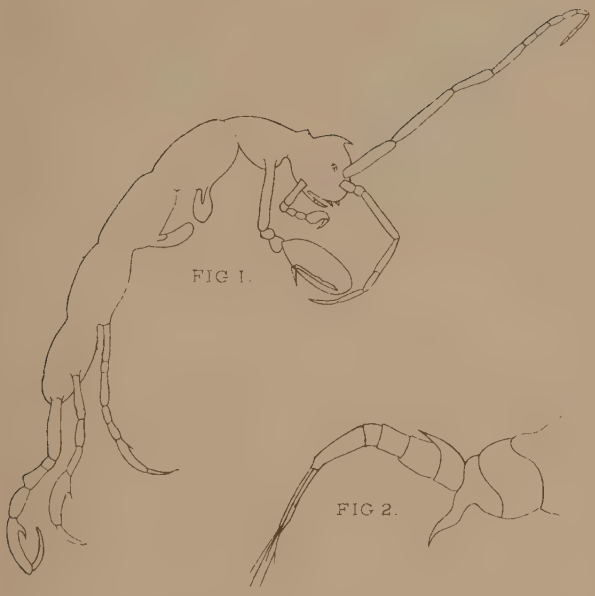
Fig. 2.

Tomas. del et lith.

D. MARPLES & Co. Lith. LIVERPOOL

Fig.I. EUCRATEA CHELATA, var ELONGATA, nov.

Fig.2. PEDICELLINA GRACILIS, var. NODOSA, nov.



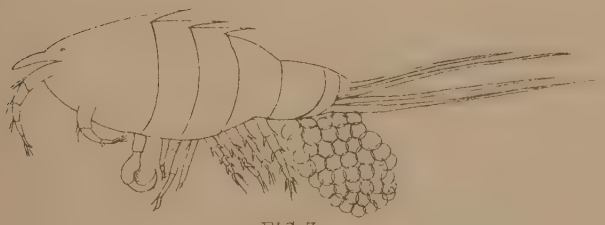


FIG. 3.

G. H. Fowler and
J. C. Thompson. Del.

D. MARPLES & Co. LIMD. LIVERPOOL

Fig. 1. PROTELLA PHASMA, Dana. (young)
Fig. 2. ANOMALOCERA PATERSONII, Temp.
Fig. 3. HARPACTICUS CHELIFER, Müll.

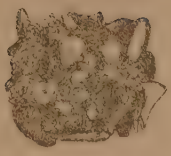


Fig. 1.

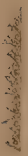


Fig. 2.

Fig. 3.

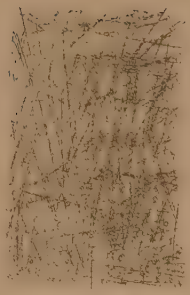


Fig. 4.

Fig. 5.

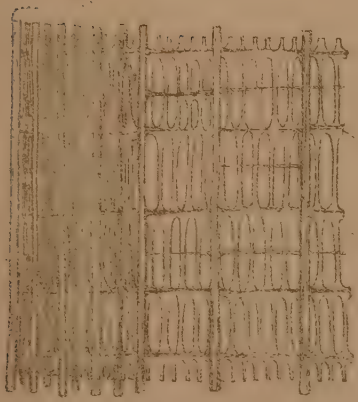


Fig. 7.

Fig. 6.

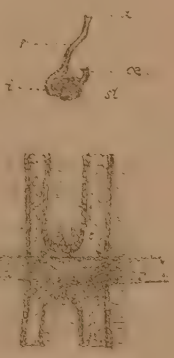


Fig. 8.

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POLYCARPA MONENSIS, n. sp.

Fig.3.

Fig.2.

Fig.1.

Fig.4.

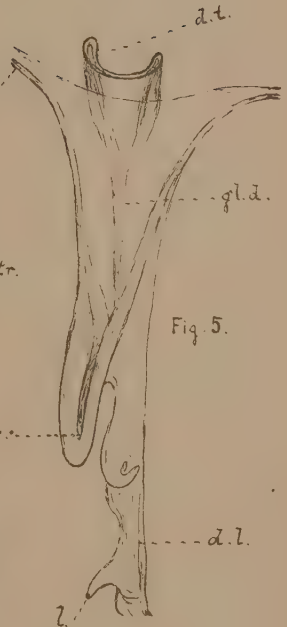

Fig.5.

Fig.6.

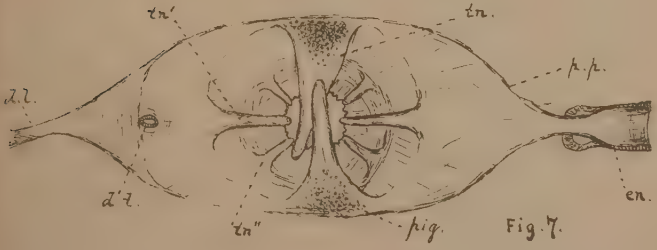

Fig.7.

W.A.H.

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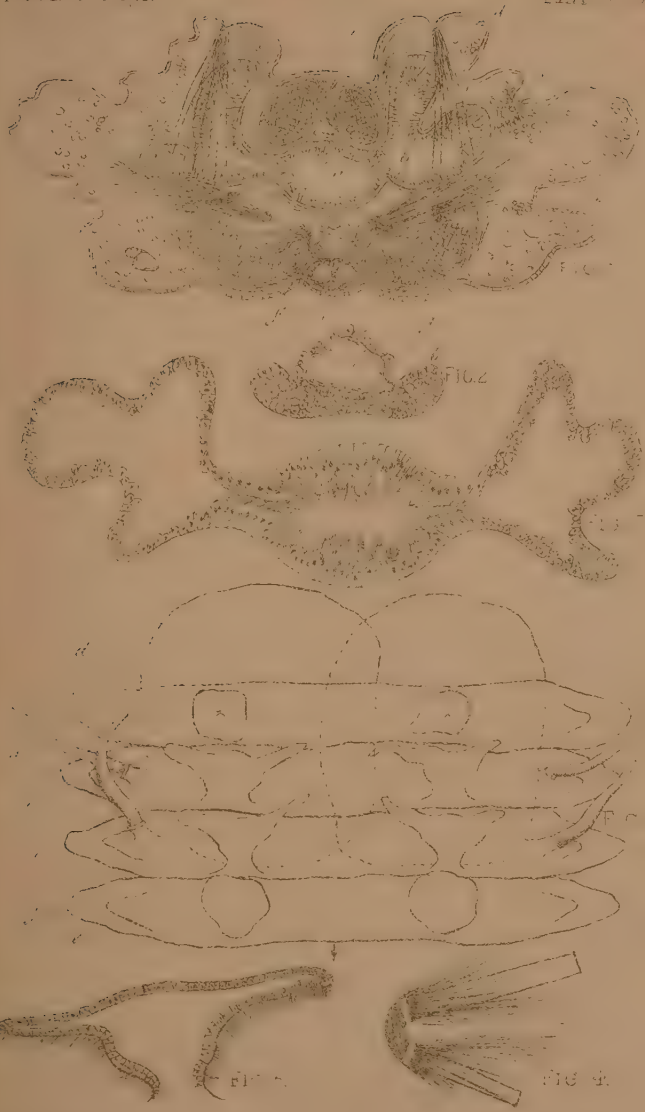
Figs 1-4. MORCHELLIOIDES ALDERI, n. sp. -
Fig 5. ASCIDIA PLEBEIA, Alder.
Fig 6. MOLGULA OCCULTA, Kupffer.
Fig 7. BOTRYLLUS SMARAGDUS, M.Edw.



MALMGRENIA CASTANEA, McIntosh.

FIG. 1

FIG. 3

FIG. 2

FIG. 5

FIG. 6

FIG. 4

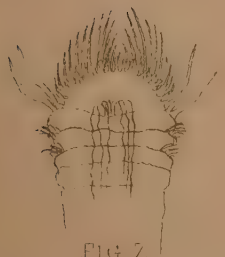


FIG. 7.

FIG. 8

FIG. 9.

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Figs. 1.2.3.4. HERMADION ASSIMILE, Mc Intosh.
Figs. 5.6.7.8.9. PECTINARIA BELGICA, Pallas.

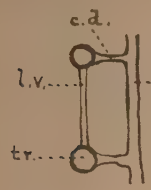

Fig. 1.

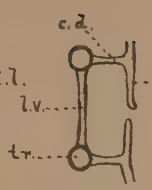

Fig. 2.

Fig. 3.

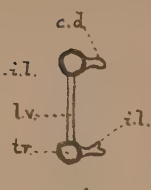

Fig. 4.

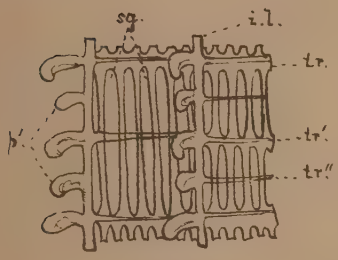

Fig. 5.

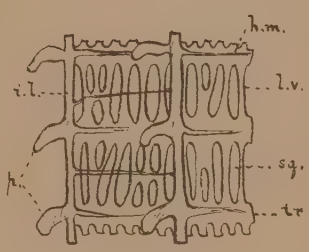

Fig. 6.

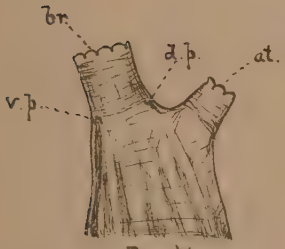

Fig. 7.

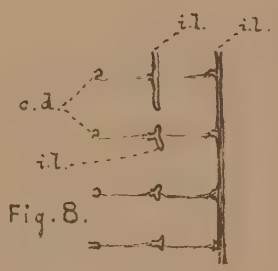

Fig. 8.

Fig. 10.

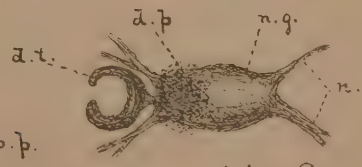

Fig. 9.

W.A.H.

Figs. 1.2.3.4. Internal longitudinal bars of various Ascidians.
Figs. 5.6.7.8.9.10. CIONA INTESTINALIS, Linn.

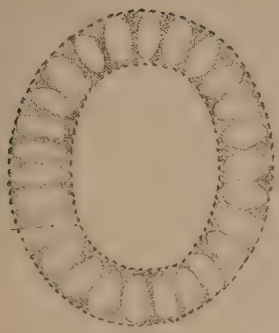

FIG. 2.

FIG. 1.

FIG. 5.

FIG. 4.

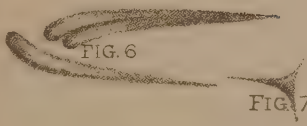

FIG. 6

FIG. 7.

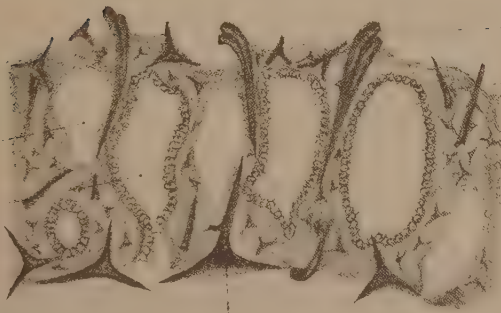

FIG. 3.

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SYCANDRA ASPERA n. sp.